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MARCH
1960

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Page 59

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VOLUME 150, NO. 4 MARCH 1960

WORLD OIL

A Gulf Publishing Company Publication

SPECIALIZED FOR EXPLORATION, DRILLING AND PRODUCING OPERATIONS AND MANAGEMENT

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A Quick Look

at this issue

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking [√] those you want to read first.

PRODUCTION PRACTICES MANUAL

☐ **The indirect line heater . . .** The indirect heater is used in conjunction with many types of gas producing units. Its chief function is to heat natural gas to a temperature sufficient to prevent formation of hydrates when line pressure and temperature are reduced. Specifically, heaters are used with most low temperature separation units, stage separation installations, glycol dehydration units, etc. For complete information on indirect heaters including sizing procedures, see Page 59

☐ **Field instrumentation and control of oil and gas well producing equipment . . .** Instrumentation and control of producing operations has advanced rapidly during the past decade. Initially, all field control was manual. But automatic devices now regulate the flow of oil and gas from wellhead to refinery. This article covers the three basic types of pneumatic control now used in the field: pressure, temperature and level. Subjects discussed include: controllers or pilots, control valves, valve selection, application and trouble-shooting. For complete information, see . . . . . Page 63

☐ **Cotton Valley discoveries spur deep pay search in East Texas Basin . . .** Although exploration is complicated by presence of truncated, piercement-type deep-seated interior salt domes, the search for deep pay in the East Texas Basin is beginning to produce results. One example is discovery of commercial quantities of gas-distillate from the Jurassic Cotton Valley sandstone (10,522-10,542 feet) in the heart of the basin. Also,

Turn the Page ▸

WORLD OIL published every month except semi-monthly in February and August. Second class postage paid at Houston, Texas. ©Gulf Publishing Co. 1960

Buckner and Smackover limestones are seen as flank objectives beneath the unconformities. For a detailed description of this significant new development, including a highly informative map of the area, turn to. . . . **Page 69**

☐ **How to drill 10,000 feet in four days and 22 hours . . .** Gulf Oil Corporation has done this while developing its Timbalier Bay field in Louisiana. The record was accomplished through full cooperation of rig personnel and improved drilling practices. These practices included: high bit weights (80,000 to 100,000), fast rotary speeds, and maximum efficient hydraulic program. For a complete discussion of this record drilling performance, turn to. . . . . **Page 72**

☐ **Better prices essential to improvement of earnings . . .** Oil industry earnings ceased to improve in the latter half of 1959, and were particularly disappointing in the fourth quarter. The unfavorable trend has continued into the first quarter of 1960, because of depressed prices of products and crude, and warmer than normal weather. If earnings are to improve, prices must be better. And prices will recover only if supplies of oils are balanced with demand and oil surpluses are reduced. . . . . **Page 75**

☐ **King-size drill collars cut surface hole drilling costs . . .** A 16½-inch drill collar string weighing 20 tons, already used successfully in two surface holes in the Alberta Foothills area, holds promise of sharply cutting drilling costs in tough, steeply dipping formations. The 56-foot set of king-size collars, at the bottom of a tapered drill collar string, demonstrated remarkable ability to maintain straight hole with maximum penetration rate. For details on this achievement, the techniques and special equipment required in handling the large collars, turn to. . . . . **Page 76**

☐ **Producers continue to spend more than they receive . . .** Proof of this statement is contained in a new study conducted by the American Petroleum Institute, Independent Producers Association of America and the Mid-Continent Oil and Gas Association. According to the report, annual production costs increased 82 percent during the 1948-1956 period, while annual receipts increased 45.1 percent. For complete details on this highly informative report, turn to. . . . . **Page 79.**

☐ **New ideas in winterizing . . .** A new drilling rig winterized for sub-zero temperatures and gale strength winds and equipped with a number of features that speed rigging-up and improve drilling operations is operating in Alaska. For details, turn to. . . . . **Page 80**

☐ **Australia is attracting oil operators . . .** The past year, 1959, was a highly significant one for petroleum development in Australia. Huge areas were placed under lease to more than a score of companies, including American, Australian, and British interests. Several deep tests were drilled or started in 1959, and more are planned for 1960 and 1961. Attractive terms of lease agreements promise to result in determined efforts to establish commercial petroleum production in this oil-thirsty commonwealth. . . . . **Page 87**

☐ **New power package cuts hydraulic pumping costs . . .** Two hydraulically pumped wells in California's Wilmington field have been equipped with a common power unit. The new system transfers energy from the hydraulic pump cylinder of the well on the downstroke to the hydraulic pump cylinder of the well on the upstroke. Thus, the weight of the rod string in one well approximately balances the weight of the rods in the second well, and the power unit must provide only that hp required to lift the fluid load of well number 2. Advantages of the system include reduced capital investment and operating costs. See. . . . . **Page 90**

☐ **Many operators entering Appalachian Basin . . .** Encouraged by the shallow oil boom in central Kentucky, by prolific gas production being found in Oriskany and Onondaga formations in western Pennsylvania and West Virginia, and by good prospects in northeastern Ohio, many U.S. operators are either entering the Appalachians for the first time or are considering this step. Favorable market conditions for crude oil and natural gas are luring some operators away from some remote southwestern areas. For a concise summary of geological and other operating conditions that such operators should anticipate, turn to. . . . . **Page 93**

☐ **Implosion technique improves fracturing performance . . .** A new well stimulation technique used in conjunction with hydraulic fracturing has been developed for use in dense, tight formations. Hollow glass capsules, collapsed or imploded opposite the pay zone prior to a fracture job, serve to clean the sand face and initiate fractures. A conventional fracturing treatment then may be performed at reduced injection pressures. Formations which previously have not responded to fracturing, have been successfully treated with the new method. . . . . **Page 100**

☐ **Radio and micro-wave facilities** are being used by a drilling contracting company to facilitate its operations in Venezuela and Colombia. An extensive network permits direct communication at all times between headquarters and the far flung field operations. Main offices in both countries keep constantly in touch with rigs, camps, marine installations and automobiles in the field. See. . . . . **Page 109**

Coming in May . . . API Drilling/Production Issue

Oil Industry In Brief

Here are the latest industry trends, revealed by WORLD OIL and industry research:

Earnings down. First quarter 1960 shows continuance of unfavorable earnings trend the oil industry experienced in fourth quarter 1959. Result: '60 earnings may be under 1959 totals . . . See Page 75.

Demand down. January-February demand for distillate fuel oil, kerosine and residuals was considerably lower than same 1959 period. Reason: Warmer than normal weather . . . See Page 25.

Prices down. Crude oil and products started 1960 at lowest price levels since downward trend started in mid-1957 . . . See Page 75.

Costs up. During next three or four years, cost-price squeeze will increase need for oil industry acquisitions and mergers. There were 519 acquisitions in 1954-59 period . . . See Page 13.

Well completions down. Continued excessive productive capacity held January U.S. well completions to 3,941, down 9.1 percent from same 1959 period . . . See Page 29.

Rig totals down. Only 3,897 rigs were operating on January 31, down 4.8 percent from December and 2.5 percent from January 1959 . . . See Page 29.

Footage down. Operators drilled an average of 545,000 feet of hole per day during January, down 52,000 feet per day or 8.7 percent from same 1959 period . . . See Page 29.

Inventories up. Total inventories on January 31 were 25 million barrels higher than same date in 1959. Light fuel oil inventories were about 30 million barrels higher than year ago levels.

WORLD OIL

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GPC PUBLICATIONS

WORLD OIL (formerly The Oil Weekly) and The COMPOSITE CATALOG for the drilling-producing industry.
PIPE LINE INDUSTRY and The PIPE LINE CATALOG for the oil and gas pipe line industry.
PETROLEUM REFINER and The REFINERY CATALOG for the oil, gas and petrochemical processing industry.

Indexed by Industrial Arts Index and Engineering Index

How to Cash in on

Looking Ahead

Soviet oil threat—new petroleum performance gage—merger trend highlight New York AIME meeting . . . How oil and gas industry is faring domestically and worldwide was prime subject at annual meeting of American Institute of Mining, Metallurgical and Petroleum Engineers, Petroleum Division, in mid-February. Capsule report on the session:

Russia's advance in world oil picture is one to watch with great care. Now a net exporter, Communist bloc appears perfectly willing to use its natural resources for political-propaganda purposes. However, worldwide overcapacity to produce (created by private enterprise) will act as powerful deterrent to Communist shenanigans. H. W. McCobb, vice president, Standard-Vacuum Oil Company.

U.S. Bureau of Mines has devised new performance measure to test contribution of oil and gas industry in an expanding economy. New index uses Federal Reserve Board indexes of production divided by oil industry's constant dollar income to determine increases or decreases in performance. When compared with other mineral industries, or total industry, a good picture of relative strength is obtained. Virgil L. Barr, assistant chief, division of Petroleum, U.S. Bureau of Mines.

During next three or four years, strong economic pressures will increase need for oil industry acquisitions and mergers. However, trend may be tempered by tighter legal restrictions. Between 1954 and 1959, there were 519 complete or partial company acquisitions, made by 238 acquiring companies or individuals. Reason: Costs have been increasing faster than crude oil prices, making it necessary to improve operating efficiency. H. Marshall Farrier, assistant to central region general manager, Continental Oil Company.

Canada to use new instrument in stepped-up Arctic oil search . . . Canada's Department of External Affairs announces that tightly guarded classified instrument will be used in all-out effort to complete mapping of Arctic Continental Shelf and Arctic Islands.

According to government sources, "Gravity Gradiometer" is so sensitive it can detect small potential oil-bearing geological structures. Device is an electric balance that has two masses suspended on thin filaments, one on top of the other, with a variable condenser. Movement of electrical mechanism identifies geological features of different densities.

Geological Survey of Canada is being provided with more money and personnel so that Arctic exploration efforts can be doubled in next five years.

Looking ahead in Washington . . . Expected moves to make political hay out of depletion provision during this presidential election year are now underway. Michigan Democratic Representative John Dingell has added his anti-depletion bill to many now in hopper—with one new twist. He is first to ask for complete elimination of depletion credits for overseas operations.

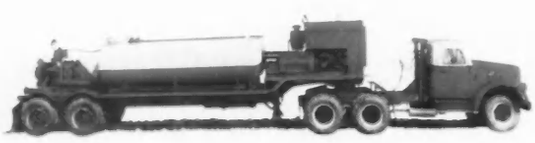
Efforts to push new natural gas bill this year have been dealt new blow by Interior Secretary Seaton. He says there is no plan to put new gas bill before this session of Congress. However, Administration will seriously consider any new bill submitted by industry associations. He still says it is up to industry to come up with workable bill, backed by full industry support.

Wide spacing in North Dakota may affect Williston Basin operations . . . North Dakota's Industrial Commission has issued temporary order setting up 320-acre spacing pattern for Rough Rider pool in McKenzie County. Order will be in effect 12 months from January 25. Williston Basin oil men are watching results of order, and many feel that future well spacing in that area may rest on outcome of new rule.

HOWCO-SORB *helps save valuable rig time . . .*
A new fine white solid that has the ability to absorb water up to four times its weight and still remain a loose, free-flowing powder . . . over 800 percent more effective than other similar materials. Howco-Sorb when used in slug treatments dries out air drilled holes in a very short time . . . giving a quick evaluation of the water shut-off results. Howco-Sorb may be used to combat seeping water and to minimize the balling of cuttings in air and gas drilling operations.

HOWCO-SUDS *helps cut air/gas drilling cost . . .*
A new water soluble surfactant blend extremely effective in both fresh and salt water . . . is very efficient in lowering surface tension of water and capable of producing large volumes of foam under a variety of conditions. When air drilling is hindered by water accumulation, large volumes of water may be foamed from the hole. Other applications of Howco-Suds are to aid in the recovery of water from drowned gas wells, help clean out water producing wells, water injection and disposal wells and may be added to water when fracturing gas wells for water recovery.

Your local Halliburton Representative will help you investigate the many other possibilities of these Halliburton water control agents helping your operations.



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Another reason for the need for true facts

". . . On the basis of current known findings, discounting future discoveries, authorities estimate U.S. oil reserves at 12.7 years. The comparable figure for gas is 22.9 years."

". . . From the attitude of the oil and gas industries, the uninformed might conclude that the energy industries are completely free of Federal or state regulation, and that the coal industry seeks to bring government, for the first time, into this field (established a national fuels policy).

". . . Because of the time needed to explore, an estimated three to five years is needed to bring in one producing well. And the time needed for pipe line construction, plus production delays, would hamper the gas industry's quick conversion to emergency status."

THESE THREE STATEMENTS are direct quotes from a 19-page attractively bound propaganda booklet given wide distribution by the National Coal Policy Conference in support of a national fuels policy study. The statements not only are misleading, they are incorrect.

The first statement was presented without mention of the fact that the liquid hydrocarbon reserves ratio has fluctuated between 12 and 13½ years for several decades, and that such ratios will continue.

The second statement has no basis in fact. The oil and gas industry simply wants to keep federal controls at a minimum, not increase them. After all, this country has thrived on free competition, not on government domination.

The third statement is equally incorrect. It was made as an argument to support coal's contention that a national fuel's policy study is needed for national security. Did oil and gas fail the United States in World War II . . . when no comprehensive fuels policy existed?

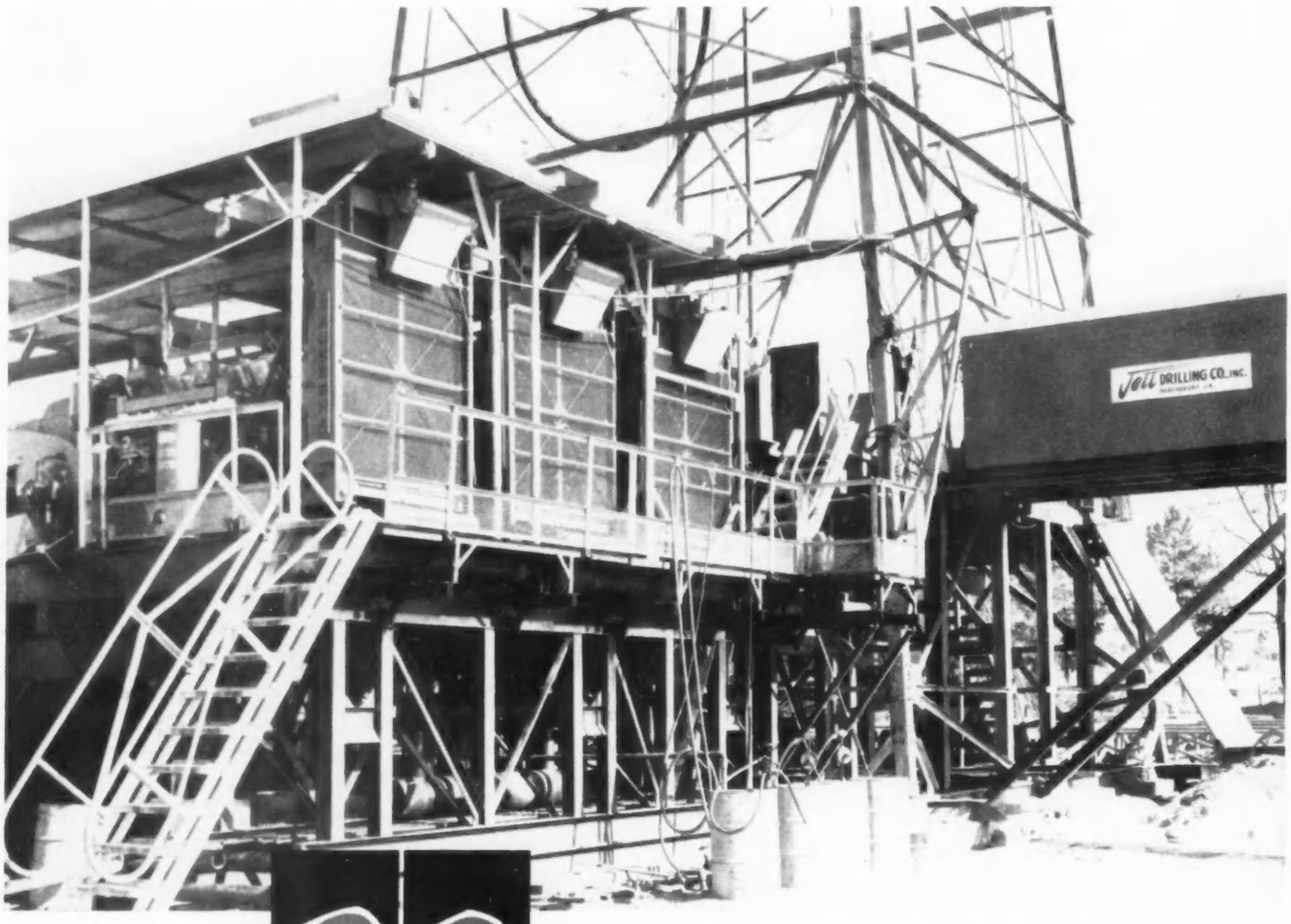
Such misstatements put further emphasis on the urgent need for the oil and gas industry to organize its forces so that the government and the public can have the true facts about the industry. The American Petroleum Institute's recent information kit answering coal's charges in the national fuels policy debate was an excellent effort toward this end. But much more needs to be done.

A similar information program should be conducted to undo some of the damage caused by recent antitrust trials against the oil industry. The general public should be informed that the Justice Department's recent failure to convict 29 oil companies of price-fixing made it "four defeats" and "no wins" in oil industry cases it has tried in recent years. Which goes to prove just one point: When peeled of Washington politics and submitted to legal test, government-instigated trials without proper knowledge of industry economics result only in a shameful waste of millions of industry and taxpayer dollars.

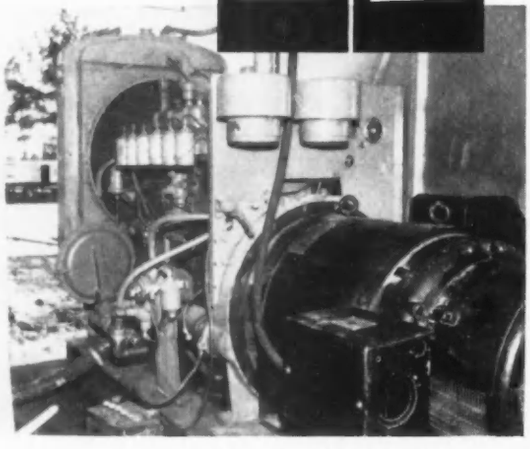
Not only must the oil and gas industry answer false charges, it also must prove the fallacy of wasting millions of dollars conducting unnecessary studies and antitrust trials.

If our forefathers had wanted a federally controlled economy, they would have established it. What they did establish, a free economy, should be kept and nourished. It has done quite well for us so far.

Let us hope our federal government will exercise enough responsibility to ignore an industry that apparently feels it must run to Uncle Sam for help whenever it is being bested under free competition.



22 WAUKESHAS
POWER 10 DRILLING RIGS



George H. Jett, of the Jett Drilling Co., Inc., Shreveport, La., relies on Waukesha power for his extensive drilling operations in Louisiana, Mississippi, and Alabama, because he's sold on Waukesha's rugged, dependable and economical long life engine operation.

Pictured above is the Jett Rig #114, powered by three Model VLROBU Waukesha Power Units, operating on natural gas. Inset shows a Waukesha "Long Life" Model 145-GZB gas unit, powering a 50 KW generating set, to supply electric power for the rig.

On nine other drilling rigs, Mr. Jett is using ten LRDBC (Diesel); six LRZB (gas); two LRORB (gas); and one NKDBSU (Diesel). With the skid arrangement and the same crankshaft center line heights on the LRDBC, LRZB, and LROR models, the Jett crews can easily change over from gas to Diesel operation in a few hours.

Waukesha can supply your oil field power needs, too.
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Mild winter puts industry in trouble

THE U.S. OIL INDUSTRY has been dealt a serious blow by the warmer than normal weather in both December and January in the principal oil-heating regions. Demand has been much lower than expected for distillate fuel oil, kerosine, and residual fuel oil. Surplus supplies of those oils accumulated. The surpluses have forced prices to very low levels.

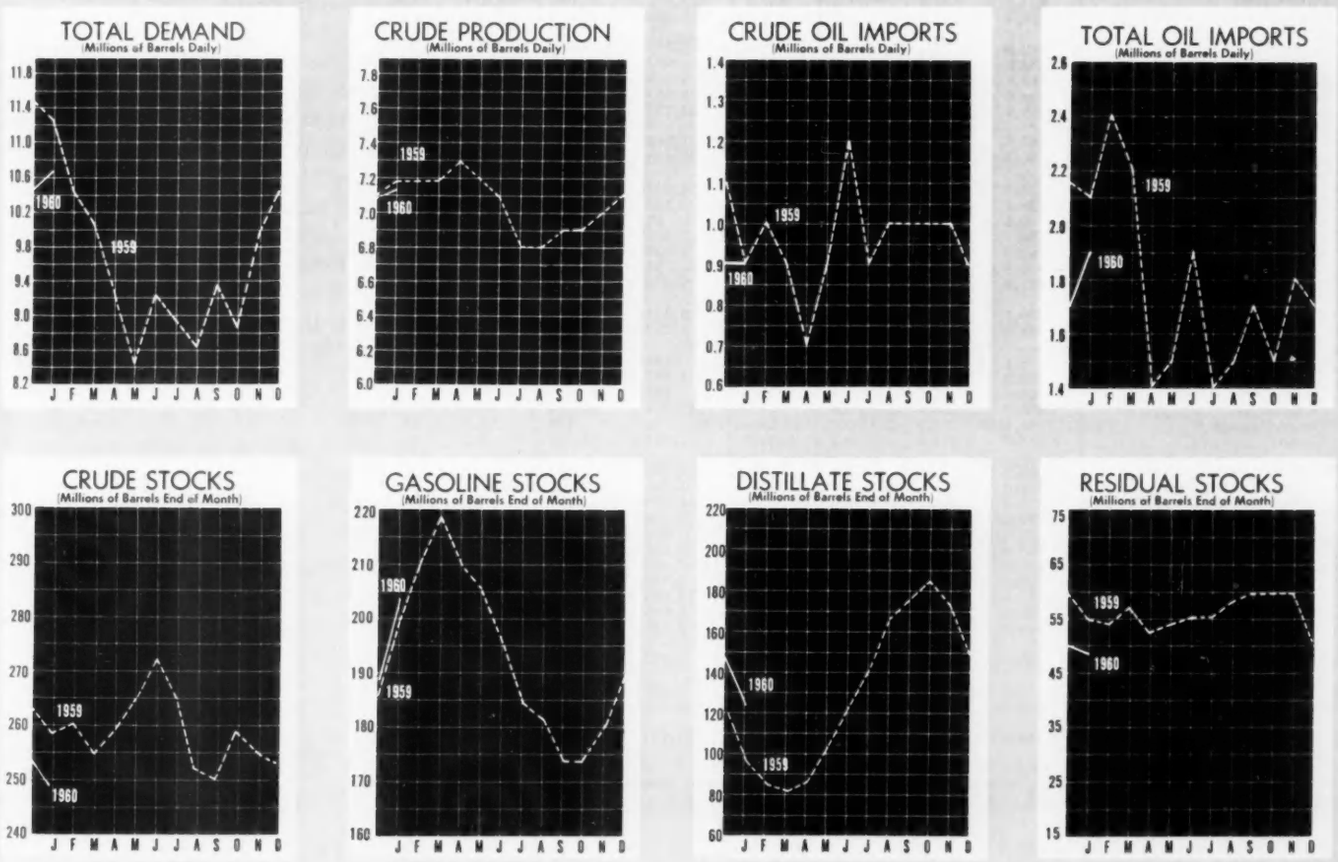
The relatively warm weather has had a doubly adverse effect on the oil industry. It has reduced oil demand out of proportion to the drop in need for fuel, as it caused some displacement of oil by natural gas. Normally, cold weather causes some industrial concerns to switch to oil while gas is diverted to residential and commercial customers. This winter, there was less need for such relinquishment of gas supplies and substitution of oil by industrial users.

Distillate fuel oil stocks are seriously excessive as a result of the relatively low demand for at least two months at the peak of the consuming season. At the end of January the stocks totaled 124,400,000 barrels, an increase of 27,600,000 barrels or 28.5 percent over the 96,800,000 barrels held January 31, 1959. Stocks of kerosine totaled 24,700,000 barrels, up 3,600,000 barrels or 17.1 percent.

Demand for distillate fuel oil in January 1960 averaged 2,789,000 barrels daily. That was 324,000 barrels daily or 4.1 percent less than the 3,113,000 barrels required in January 1959. In December 1959 distillates demand had averaged 2,535,000 barrels per day, a drop of 644,000 barrels or 20.3 percent from unusually cold December 1958.

For the two months, January 1960 and December 1959, combined, the distillate fuel oil demand was under a year previously by almost 500,000 barrels daily. Multiplied by 62 days, that meant 30 million barrels less December-January demand than last winter. Yet that amount of distillate was made available, and instead of

Petroleum Trends...



U.S. Petroleum Demand and Supply (Thous. Bbls. Daily)

ITEM	JANUARY 1960	JANUARY 1959	JANUARY % Diff.	December 1959
DEMAND				
All Oils, Total Demand	10,738	11,312	— 5.1	10,551
Domestic Demand	10,518	11,042	— 4.7	10,311
Export Demand	220	269	— 18.2	240
Gasoline, Total Demand	3,640	3,751	— 3.0	3,926
Distillate, Total Demand	2,789	3,113	— 4.1	2,535
Kerosine, Total Demand	453	583	— 22.3	526
Residual, Total Demand	1,943	2,134	— 8.9	1,810
Other Oils, Total Demand	1,913	1,731	+10.5	1,754
CHANGE IN STOCKS				
All Oil, Change in Stocks	732	1,133		800
NEW SUPPLY				
Total New Supply	10,006	10,178	1.7	9,751
Domestic Production, Total	8,065	8,065	0.2	8,008
Crude Oil	7,160	7,224	0.9	7,102
Natural Gas Liquids	905	861	+ 5.1	906
Imports, Total	1,941	2,094	7.3	1,743
Refined Products	1,026	1,169	12.2	799
Crude Oil, Total	916	925	1.0	944
Crude, East Coast	689	771	10.6	656
CRUDE RUNS				
Crude Runs to Stills	8,262	8,230	+ 0.4	8,152
Domestic Crude	7,359	7,252	+ 1.5	7,191
Foreign Crude	903	978	7.7	961

U.S. Stocks of Oils (Million Bbls. at End of Month)

KIND OF OIL	TOTAL IN U.S. Jan. 1960	Jan. 1959	% Diff.	Dec. 1959	EAST OF CALIFORNIA Jan. 1960	Jan. 1959	% Diff.	Dec. 1959
All Oils	780.9	754.2	— 3.5	803.6				
Crude Oil	248.9	258.1	3.6	253.6	216.6	219.2	1.2	219.8
Gasoline	204.6	199.0	— 2.8	189.0	175.1	172.3	1.6	161.0
Distillate Fuel Oil	124.4	96.8	— 28.5	148.8	112.7	84.7	— 33.1	135.4
Kerosine	24.7	21.1	— 17.1	26.8	24.3	20.7	— 17.4	26.3
Residual Fuel	47.8	55.2	13.4	49.9	29.7	25.6	— 16.0	27.9
Other Oils	130.5	124.0	— 5.2	135.5				

U.S. Crude Oil Production, by States (Thous. Bbls.)

STATE or DISTRICT	Daily Average for January 1960	1959	% Diff.	Dec. 1959	Total for January 1960	1959	% Diff.
Alabama	17.0	15.2	+ 11.8	15.8	527	472	+ 11.7
Arkansas	70.0	81.0	— 13.6	59.1	2,171	2,510	— 13.5
California	835.2	844.7	— 1.1	837.7	25,892	26,186	— 1.1
Colorado	128.4	125.3	+ 2.5	129.0	3,981	3,885	+ 2.5
Florida	1.2	1.3	— 7.7	1.3	37	39	— 5.1
Illinois	218.0	222.8	— 2.2	218.0	6,759	6,906	— 2.0
Indiana	32.0	33.6	— 4.8	31.5	992	1,041	— 4.7
Kansas	311.9	335.8	— 7.1	325.5	9,668	10,415	— 7.2
Kentucky	64.0	64.0		65.5	1,983	1,983	
Louisiana	1,069.6	942.7	+ 13.5	1,046.6	33,157	29,224	+ 13.5
North Louisiana	113.3	122.8	— 7.7	113.6	3,512	3,807	— 7.8
South Louisiana	956.3	819.9	+ 16.6	933.0	29,645	25,417	+ 16.6
Michigan	33.3	25.2	+ 32.1	33.9	1,031	780	+ 32.2
Mississippi	146.7	120.4	+ 21.8	146.2	4,547	3,734	+ 21.8
Mo.-So. Dak.-Tenn.	0.6	0.1	+500.0	0.5	19	3	+533.3
Montana	80.2	79.4	+ 1.0	80.5	2,486	2,460	+ 1.1
Nebraska	62.9	59.2	+ 6.3	63.4	1,949	1,835	+ 6.2
Nev.-Wash.-Alaska-Ariz.	0.8	1.1	— 27.3	0.5	25	35	— 28.6
New Mexico	301.0	273.9	+ 9.9	296.0	9,330	8,489	+ 9.9
Southeast New Mexico	259.1	249.8	+ 3.7	255.4	8,031	7,743	+ 3.7
Northwest New Mexico	41.9	24.1	+ 73.9	40.6	1,299	746	+ 74.1
New York	5.1	6.0	— 15.0	5.3	159	188	— 15.4
North Dakota	58.0	47.5	+ 22.1	59.6	1,797	1,474	+ 21.9
Ohio	13.0	14.1	— 7.8	11.8	402	436	— 7.8
Oklahoma	556.9	553.4	+ 0.6	550.2	17,264	17,154	+ 0.6
Pennsylvania	16.5	15.5	+ 6.4	16.4	512	479	+ 6.9
Texas	2,673.5	2,912.9	— 8.2	2,641.8	82,882	90,300	— 8.2
Dist. 1: South Central	43.0	44.6	— 3.6	45.8	1,334	1,384	— 3.6
Dist. 2: Middle Gulf	121.5	128.5	— 5.1	119.0	3,766	3,969	— 5.1
Dist. 3: Upper Gulf	378.2	418.4	— 9.6	370.9	11,725	12,970	— 9.6
Dist. 4: Lower Gulf	189.6	204.9	— 7.5	189.3	5,878	6,352	— 7.5
Dist. 5: East Central	27.4	31.3	— 12.5	26.4	850	969	— 12.3
Dist. 6: Northeast	263.3	290.5	— 9.4	256.7	8,161	9,007	— 9.4
Dist. 7-B: North Central	135.5	142.4	— 4.9	128.2	4,200	4,415	— 4.9
Dist. 7-C: West Central	127.1	143.8	— 11.6	128.3	3,940	4,459	— 11.6
Dist. 8: West	1,083.6	1,128.7	— 4.0	1,061.4	33,593	34,991	— 4.0
Dist. 9: North	195.0	211.5	— 7.8	206.9	6,046	6,557	— 7.8
Dist. 10: Panhandle	109.3	105.1	+ 4.0	108.9	3,389	3,257	+ 4.1
Utah	109.3	107.7	+ 1.5	113.7	3,387	3,339	+ 1.4
Virginia							
West Virginia	5.7	5.5	+ 3.6	5.9	178	170	+ 4.7
Wyoming	349.5	335.1	+ 4.3	346.0	10,836	10,388	+ 4.3
Total, U.S.	7,160.3	7,223.4	— 0.9	7,101.7	221,971	223,926	— 0.9

Sources for above 3 tables: Bureau of Mines monthly reports, except last two months based on API and B. of M. weekly reports and WORLD OIL estimates, and all Texas districts from API.

being used, it was added to storage and represented surplus.

At the middle of February, Gulf Coast refiners generally followed a new reduction of 3/8 cent a gallon on No. 2 distillate fuel oil, and at the same time marked down kerosine one half cent a gallon. The 3/8 cent cut in No. 2 fuel oil was made in addition to a somewhat earlier reduction of one quarter cent a gallon. It brought cargo prices generally down to 8 cents a gallon. It was believed that some sales were being made at even lower prices.

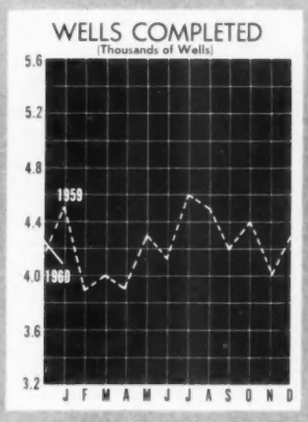
The price of 8 cents a gallon was not much more than the value of the crude oil from which the product was made. A barrel of the No. 2 fuel oil at 8 cents a gallon would be worth $3.36. The present U.S. average price of crude oil at the well is about $2.93 per barrel. Delivered at the refinery, the crude costs well over $3.00 a barrel.

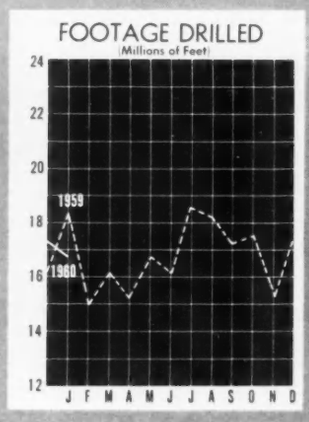
On the East Coast, in the Middle West, and in the Mid-Continent, also, there were reductions in wholesale prices of No. 2 fuel oil around the middle of February. The going price in the Group 3 region (Mid-Continent) was down to 9 cents a gallon, compared with 10 cents one year previously. No. 6 residual fuel oil, Group 3, was priced at $1.80 per barrel, compared with $1.90 a year earlier.

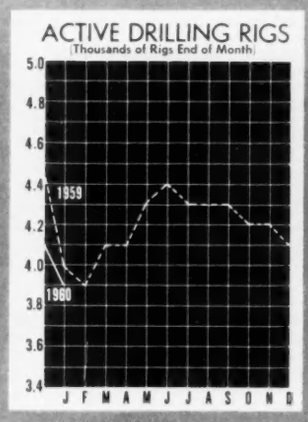
The gasoline situation also has become less favorable. Demand for gasoline in January 1960 was 3 percent lower than in January 1959. Stocks increase seasonally each January, but with demand lagging, they increased more than usual this January. On January 31 this year they totaled 204,600,000 barrels, up 5.6 million barrels or 2.8 percent over one year previously. Perhaps justifying this increase is the Bureau of Mines forecast that gasoline demand will be 3.1 percent greater in 1960 than in 1959.

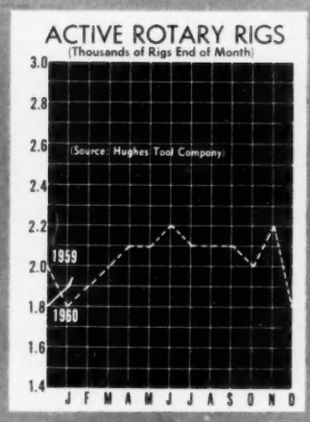
Prices of gasoline at mid-February remained steady on the Gulf Coast, but were sagging in some other areas. Regular grade gasoline on the Gulf Coast in cargo lots was priced at 10¾ cents per gallon, compared with 10¼ cents one year previously. But in the Group 3 market 91 octane was 11 cents, compared with 12⅜ cents a year earlier. In Pennsylvania gasoline prices to dealers were cut about one half cent per gallon at mid-February. The gasoline markets were weak also in the Middle West and the Mid-Continent.

Drilling Activities.









Sharp drop in January drilling activity

SEVERE WINTER weather combined with continued excessive productive capacity to hold January new well completions 9.1 percent below the same 1959 period. During the first month of 1960, operators completed 3,941 new wells, for a drop of 393 wells from the January 1959 total.

The January 1960 total also was down 177 wells or 4.3 percent from the 4,118 wells completed in December. This was a reversal from last year, when the January total of 4,334 new completions reflected a sharp increase of 375 wells or 9.5 percent over December 1958.

Only 3,897 cable tool and rotary rigs were operating on January 31, down 197 rigs or 4.8 percent from December 31, and 100 rigs or 2.5 percent from January 31, 1959.

Operators drilled an average of 545,000 feet of hole per day during January, for a decrease of 16,000 feet per day or 2.8 percent from December. The January average also was 52,000 feet per day or 8.7 percent below the January, 1959 record.

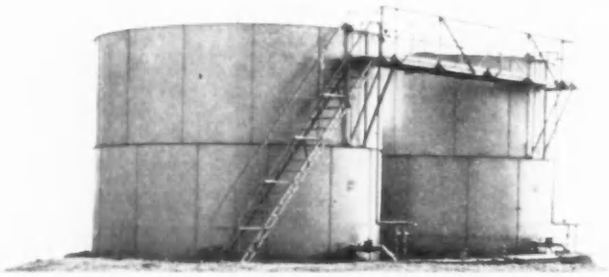
Wildcatting activity increased slightly (5 wells) in January over the December total of 892 wells. However, the total was down 12 wells or 1.3 percent from January 1959.

Summary of U.S. Wildcat Drilling

ITEM	January 1960	December 1959	January 1959	% Diff. January 1960-1959
New Field Discoveries:				
Oil	64	65	68	— 5.9
Distillate	8	3	10	—20.0
Gas	19	24	29	—34.5
Total Discoveries	**91**	**92**	**107**	**—15.0**
Dry Wildcats	**806**	**800**	**802**	**+ 0.5**
Total Wildcats	**897**	**892**	**909**	**— 1.3**
Percent Productive	10.1	10.3	11.8	.....
Percent Dry	89.9	89.7	88.2	.....

Summary of U.S. Drilling Activity

ITEM	January 1960	December 1959	January 1959	% Diff. January 1960-1959
Oil	1,859	1,957	2,264	—17.9
Distillate	86	67	75	+14.7
Gas	358	374	306	+17.0
Service	34	60	61	—44.3
Dry	1,604	1,660	1,628	— 1.5
Total Wells	**3,941**	**4,118**	**4,334**	**— 9.1**
Footage Drilled (Million Feet)	**16.9**	**17.4**	**18.5**	**— 8.7**



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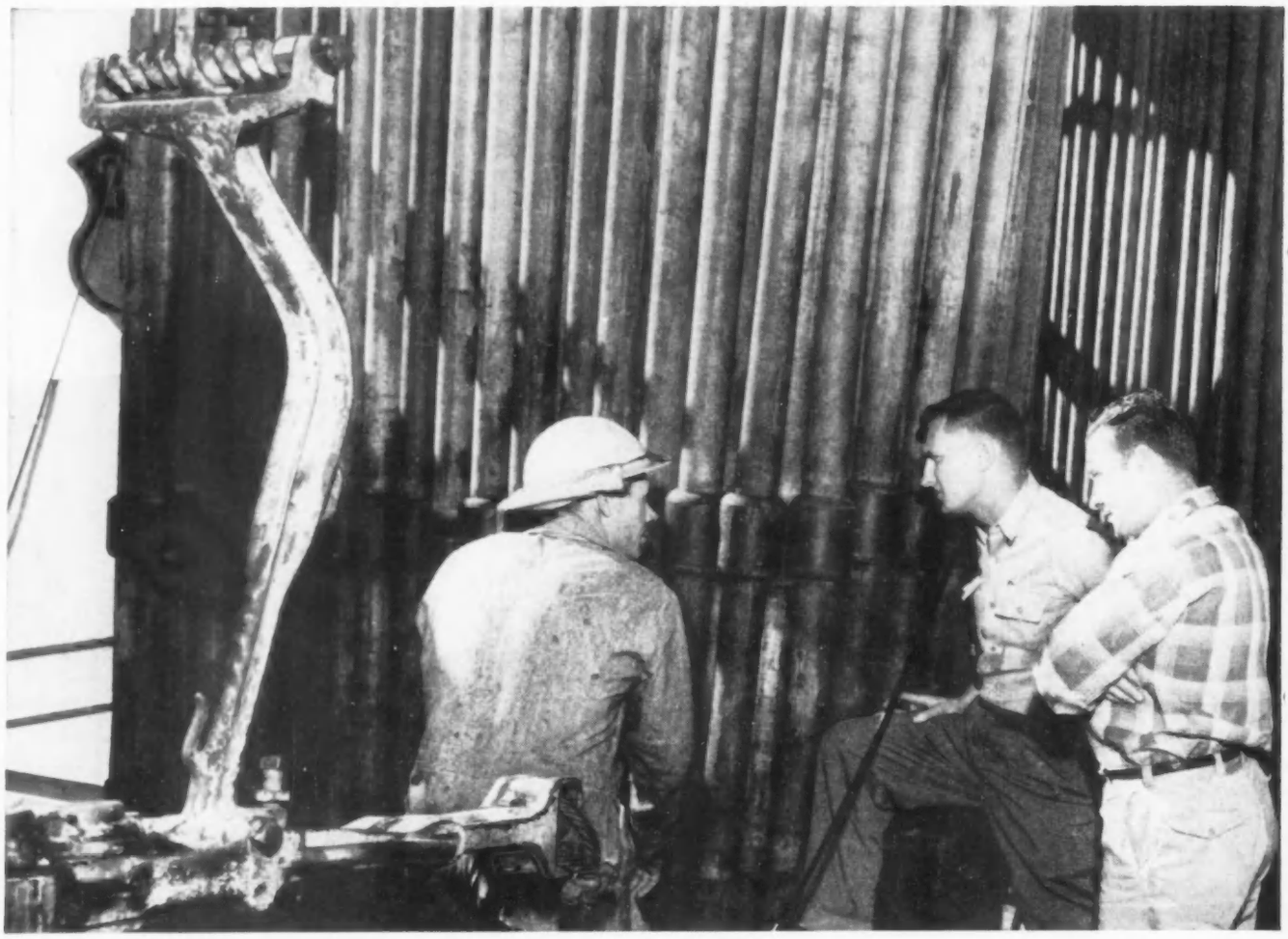
U. S. Drilling Activity in January Compared With Year Ago

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR JANUARY — Oil	Dist.	Gas	Dry	Service Wells	TOTAL NEW WELLS — Jan. 1960	Dec. 1959	Jan. 1959	% Diff. January 1960-1959	TOTAL FOOTAGE — January 1960	January 1959	WILDCAT DRILLING JANUARY: NEW FIELDS IN JANUARY — Oil	Dist.	Gas	TOTAL DISCOVERIES — Jan. 1960	Dec. 1959	Jan. 1959	DRY WILDCATS — Jan. 1960	Dec. 1959	Jan. 1959	TOTAL WILDCAT TESTS — Jan. 1960	Dec. 1959	Jan. 1959	DRILLING RIGS IN OPERATION (Rigging Up, Drilling, Tem. Shut-Down) — Jan. 31, 1960	Dec. 31, 1959	Jan. 31, 1959
Alabama	5			2		7	9	12	— 41.7	51,152	122,598							2	2	1	2	2	1	3	6	17
Alaska				1		1	1	1		11,200	12,046						1	1	1		1	1	1	5	7	5
Arizona				1		1	6			6,595								1	6		1	6		2	2	2
Arkansas	29		3	18		50	58	82	— 39.0	172,556	255,711						1	10	8	11	10	8	12	34	45	41
California	74		10	37	1	122	169	122		576,249	556,531	2		2	4	2	4	27	33	23	31	35	27	95	126	135
Colorado	17		14	59		90	64	54	+ 66.7	490,845	306,029	4		1	5	2	4	42	35	29	47	37	33	80	42	49
Illinois	97		1	142		240	121	248	— 3.2	499,423	553,708	3			3	2		80	25	57	83	27	57	274	324	249
Indiana	30			50		80	75	73	+ 9.6	109,377	121,819							28	29	20	28	29	20	114	92	101
Kansas	147		18	162	7	334	387	327	+ 2.1	1,215,113	1,184,813	13		2	15	20	20	78	102	82	93	122	102	246	245	319
Kentucky	125		21	89		235	245	211	+ 11.4	195,815	205,939						1	7	8	12	7	8	13	138	180	137
Louisiana	106	22	30	85		243	359	363	— 33.1	2,025,448	2,992,393	3	2		5	3	11	26	41	41	31	44	52	323	325	333
North Louisiana	35		11	24		70	167	111	36.9	246,782	420,241					2	4	9	21	12	9	23	16	59	50	62
South Louisiana	71	22	19	61		173	192	252	— 31.4	1,778,666	2,572,152	3	2		5	1	7	17	20	29	22	21	36	264	275	271
*Gulf of Mexico	27	2	1	9		39	51	56	— 30.4	382,776	547,028					1	1	1	1	1	1	2	2	54	58	35
Michigan	23		4	32		59	48	39	+ 51.3	200,309	112,288	1			1	1	2	21	15	10	22	16	12	100	115	82
Mississippi	30	1	2	32		65	76	68	— 4.4	554,247	614,831	1			1	1	4	24	29	24	25	30	28	85	77	63
Missouri	1			1		2				6,800														1	3	
Montana	6		2	11		19	44	27	— 29.6	81,456	128,303	1		2	3	1		7	12	6	10	13	6	32	42	36
Nebraska	36			90		126	70	45	+180.0	759,198	232,859	3			3	3	3	48	37	15	51	40	18	33	25	32
New Mexico	99		37	43		179	167	116	+ 54.3	829,555	500,382	9		2	11	8	3	31	25	16	42	33	19	133	173	168
Southeast	74		3	33		110	108	68	+ 61.8	528,470	324,757	6		2	8	3	3	25	21	13	33	24	16	70	98	76
Northwest	25		34	10		69	59	48	+ 43.8	301,085	175,625	3			3	5		6	4	3	9	9	3	66	75	92
New York	13		1	4	7	25	24	22	+ 13.6	43,500	37,190													25	25	25
North Dakota	16			11		27	51	36	— 25.0	167,826	244,067					3	3	6	13	5	6	16	8	37	25	36
Ohio	40		27	20		87	121	73	+ 19.2	235,383	203,210	1			1	3	1	3	4		4	7	1	188	210	195
Oklahoma	191	9	31	144	3	378	337	593	— 36.3	1,634,017	2,074,213	4	1	4	9	12	12	44	37	75	53	49	87	499	495	465
Pennsylvania	18		26	8	13	65	62	42	+ 54.8	192,918	122,056					1		2	2		2	3		195	186	165
South Dakota	1			4		5	3			28,984								3	1		3	1		5	5	2
Tennessee	1			20		21		10	+110.0	21,000	10,000							10		2	10		2	25	25	25
Texas	706	54	84	478		1,322	1,403	1,607	— 17.7	6,142,935	7,192,920	18	5	6	29	25	30	265	281	331	294	306	361	862	971	1,000
Dist. 1: South Central	42	2	4	41		89	96	89		268,912	244,190					1	1	25	28	25	25	29	26	37	38	35
Dist. 2: Middle Gulf	18	12	8	25		63	49	69	— 8.7	422,216	432,766		1		1	3	5	16	20	20	17	23	25	51	58	48
Dist. 3: Upper Gulf	46	22		38		106	107	107	— 0.9	776,327	743,640	1	2		3	3	7	24	24	22	27	27	29	89	96	74
*Gulf of Mexico																										1
Dist. 4: Lower Gulf-S.W.	19	18	10	39		86	100	113	— 23.9	492,665	619,387	2	2	2	6	2	4	25	34	39	31	36	43	61	64	60
*Gulf of Mexico			1	28		29	22	13	+123.1	100,683	78,047			1	1			18	15	8	19	15	8	15	8	13
Dist. 5: East Central	54		4	27		85	77	76	+ 11.8	429,169	409,118	2			2	1	1	13	19	14	15	20	15	51	47	52
Dist. 6: Northeast	72		8	97		177	171	204	— 13.2	611,188	684,395	6		3	9	8	2	61	61	67	70	69	69	97	92	85
Dist. 7-B: North Central	33		5	22		60	51	57	+ 5.3	268,444	243,672	2			2		1	18	19	18	20	19	19	77	71	53
Dist. 7-C: West Central	258		7	40		305	302	470	— 35.1	1,604,835	2,326,681	4			4	6	4	18	17	59	22	23	63	177	250	324
Dist. 8: West	95		10	99		204	320	300	— 32.0	606,703	883,152	1			1	1	1	36	31	49	37	32	50	128	157	169
Dist. 9: North	69		27	22		118	108	109	+ 8.3	561,733	524,872						4	11	13	10	11	13	14	79	90	87
Dist. 10: Panhandle																										
Utah	4			8		12	32	34	— 64.7	58,940	205,190	1			1	1	1	8	10	14	9	11	15	45	30	36
Washington							1												1			1		1	1	
West Virginia	19		42	7		68	70	58	+ 17.2	175,790	138,500					4	6	30	42	27	30	46	33	204	210	174
Wyoming	25		5	43	3	76	110	70	+ 8.6	382,570	360,684							2	1	1	2	1	1	107	78	96
Others				2		2	2	1	+100.0	14,705	4,748													6	4	9
Total United States	1,859	86	358	1,604	34	3,941	4,118	4,334	— 9.1	16,883,906	18,493,028	64	8	19	91	92	107	806	800	802	897	892	909	3,897	4,094	3,997
Total Western Canada	146		20	67	1	234	233	191	+ 2.1	1,299,525	989,094													234	249	242

* Gulf of Mexico wells are included in their respective district total.



Checking the 4340 nickel alloy steel pipe during drilling of the world's deepest exploratory well — Phillips 1-EE University. The top portion of the string was made up of this 4340 pipe when the well hit 25,340 feet.

World's deepest well completed with the help of nickel alloy steel drill pipe

When Phillips 1-EE University Well reached beyond 23,000 feet, the drilling crew halted operations. At these depths, drill string failure was a dangerous possibility.

The drillers' job was to keep it from happening.

They did it by running in 10,500 feet of nickel alloy steel drill pipe as the top section of the string. Drilling began again, and the well was completed at a world's record 25,340 feet.

National Supply Company, maker of the 3½-inch drill pipe used at the well, names it "Spang P-105". It's made from 4340 nickel-chrome-moly steel, heat-treated to a yield strength of 105,000 pounds per square inch.

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View of the Phillips Petroleum Company rig in Pecos County, Texas. Nickel alloy steel drill pipe is in position and ready to be run into the hole.

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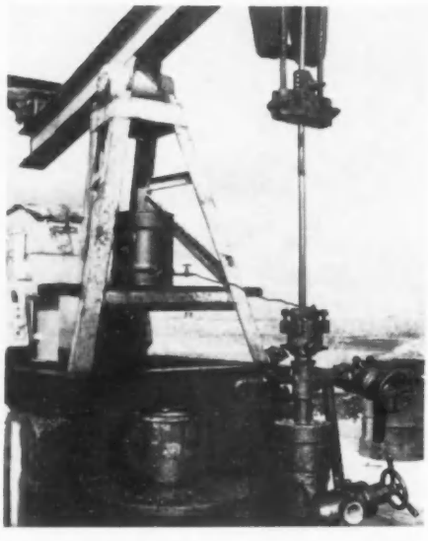
Let Storage Bin Act as Shield for Rig Cordage

Use storage bins to protect rig cordage from weather and rig drippings. The heavy-gage cylindrical steel bins, each sized to accommodate a coil of the particular type of rope, are fitted with slightly dished round covers. A 3-inch nipple with rounded edges is welded in the center of the cover. The rope is withdrawn through this when needed.

Place these containers on a floored section of the rig substructure where they will be readily available when a new length of rope is needed. They also can be easily reached by trucks delivering new coils.



Make Old Drum a Reservoir On Polish Rod Stuffing Box

This operator has utilized an old drum as an oil reservoir for the polish rod stuffing box. A ¼-inch collar is welded to the lower portion of the can. A ¼-inch nipple and needle valve with a length of copper tubing complete the installation. The drum is filled with oil and placed on the unit. The copper tubing is extended until it rests on the packing gland.

The ¼-inch valve then is opened slightly so that oil flows from the drum very slowly. The rate of flow is adjusted so that just enough oil is deposited on the polish rod to keep it from burning the packing. The set-up is very simple, cheap to install and may prevent a polish rod packing failure.

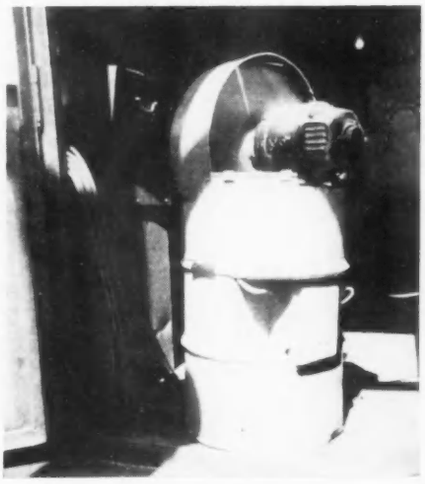
Make Truck Towing 'Eyes' From Junk Sucker Rod

Use a piece of junk sucker rod, formed to fit underneath the bumper, to make towing "eyes" for cars or pickup trucks used in the field. Flatten the ends of the sucker rod so that holes can be drilled and rods mounted underneath front and rear bumpers. Use the bolt holes already drilled in the frame of the vehicle. These tow bars can be installed at minimum cost in a short time.

Level Mast Supports With Adjustable Legs

To avoid harmful twists or strains when lowering the mast, one contractor has designed his supports so that regardless of ground irregularities, he can quickly adjust the level by turning a lower threaded section in each leg until the top I-beam member is absolutely horizontal.

Above the threaded section, the leg moves up or down through a 30-inch sleeve. This type of support eliminates the need of leveling small irregularities in the ground with pick and shovel. The threaded section can be adjusted to compensate for any subsequent settling. Broad footings of channel iron provide stable bases that can span small irregularities and "float" on soft sand or earth.



Use Drum-Mounted Fan To Cool Engine Room

Mount a fan on a steel drum to provide additional cooling at the engine room work bench on barge rigs. Connect the fan to front of the motor and place the unit on a plate which fits inside the top of the drum. Form a band of steel around the blades to protect workers and effect more efficient operation of the fan. Mount the operating switch on the side of the drum. Weld handles to side of the drum to facilitate moving.

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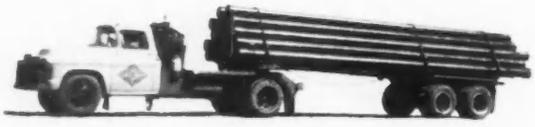

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A portable air compressor and volume tank which can be connected to the pumpers lease car or truck can be rigged up with material from the scrap pile. Two-inch pipe and steel strap material are used to construct the volume tank frame. A set of wheels from a pipe buggy are installed on the rear of the frame. A scrap section of conductor pipe with closed, welded ends is used for the volume tank. It is installed on the pipe frame as shown.

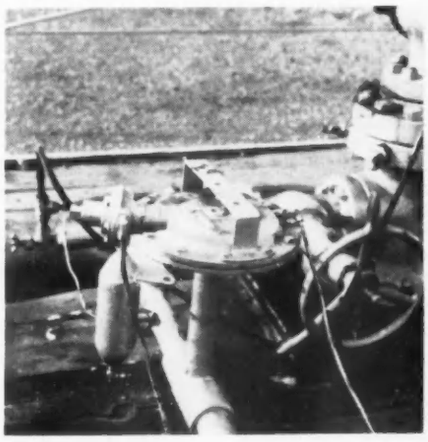
A small air compressor and engine are mounted piggy-back on top of the volume tank. A two-inch connection in the top, a ¼-inch valve for an air hose in the bottom and a pressure gage complete the unit.

Four Vertical Tanks Make Compact Lube Storage Unit

This lube oil storage unit is compact and portable. Four vertical welded tanks are used instead of the conventional 50-gallon storage drum involving a long rack. Tanks are mounted on a small elevated platform made of salvaged drill pipe and angle iron. A vertical post in the center of the rack serves two main pur-

poses: it provides a lifting bail with which the entire unit can be picked up and moved and four radiating horizontal steel arms with steel bands attached are welded near the top post. These steel bands encircle the four tanks, holding them in position.

A 1-inch right angle valve is brought out from the bottom of each tank to a common line, allowing easy filling of containers. The expanded metal platform in front of the unit allows drippings to fall onto the ground, eliminating a dangerous oil-slick surface. The unit takes less space than conventional drum racks. It can be spotted easily and just as easily picked up and handled during moving operations.



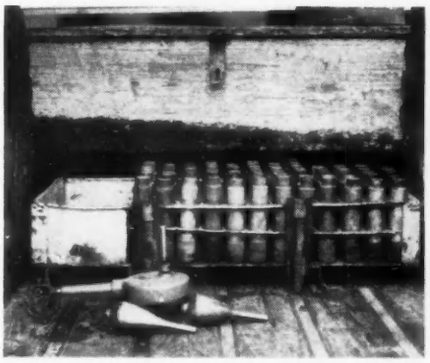
Carry Intermitters Easily With U-Shaped Steel Strap

Here's a unique, simple trick which makes transfer of motor valves or intermitters easy. As illustrated, a perforated steel strap bent into a U shape is installed on top of the diaphragm case. Bolts which hold the top and bottom diaphragm cases together are extended through the strap securing it to the valve.

The strap also provides a receptacle for a bar or rod so that the valve topworks may be easily unscrewed from the valve body. Valves are readily broken out and carried through use of the handle, and a normally awkward piece of equipment is handled easily.

Convenient Choke Rack Proves To Be Time Saver

The convenient choke rack shown in the photograph has been installed in a South Texas operator's lease truck. Since the field man was required to supervise production from 157 wells, it was sometimes difficult



to find the correct size choke at the right time. To correct this situation, this 60-choke capacity rack was constructed.

Two handles are provided so that the rack can be placed under the tool box when the vehicle is traveling, thus protecting chokes from dirt and debris. The angle iron sections installed on the bed of the pick-up serve as guides for runners mounted on the bottom of the rack. The steel box mounted on the left side of the rack contains choke wrenches and other necessary tools. The rack saves time and keeps beans in good condition.

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Bethlehem Wire Rope Serves Work-Over Job in Northward Field—This is a recent work-over job by the J. C. Lewis Drilling Company on Well 15 in the Northward Field, near Wickett, Texas. The Bethlehem wire ropes were 5,500 ft of $\frac{7}{8}$-in. 6 x 21 Type U Plow, right lay, with fibre core, and 5,000 ft of $\frac{9}{16}$-in. 6 x 7 Formset, Purple Strand, right lay, with fibre core. As usual, the rope provided top-notch performance—one of the reasons why it's a favorite with drillers everywhere.

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WORLD OIL'S PRODUCTION PRACTICES MANUAL

III. Continued from February Issue

PRODUCING EQUIPMENT FOR NATURAL GAS WELLS

The third installment of WORLD OIL's Production Practices Manual describes and illustrates operating features of:

- Indirect Flow Line Heaters.
- Instrumentation and Control for Field Units.

For those who missed the previous two installments, technical operating information was provided on Conventional Separators . . . Mechanical Low Temperature Separation Units . . . Long Cycle Dry Desiccant Dehydrators . . . Glycol Dehydrators . . . Short Cycle Recovery Units . . . Ammonia Refrigeration Units as used in Low Temperature Separation.

Save the three parts of this series. They represent the first manual to be published that describes completely equipment used in producing natural gas—written especially for producers.

8. THE INDIRECT LINE HEATER

By John W. Dorsey, Vice President, Engineering
Tyson Smith Company, Houston

THE INDIRECT FLOW LINE HEATER is used to heat natural gas to a temperature sufficient to prevent hydrate formation when line pressure and temperature are reduced. Some specific applications are:

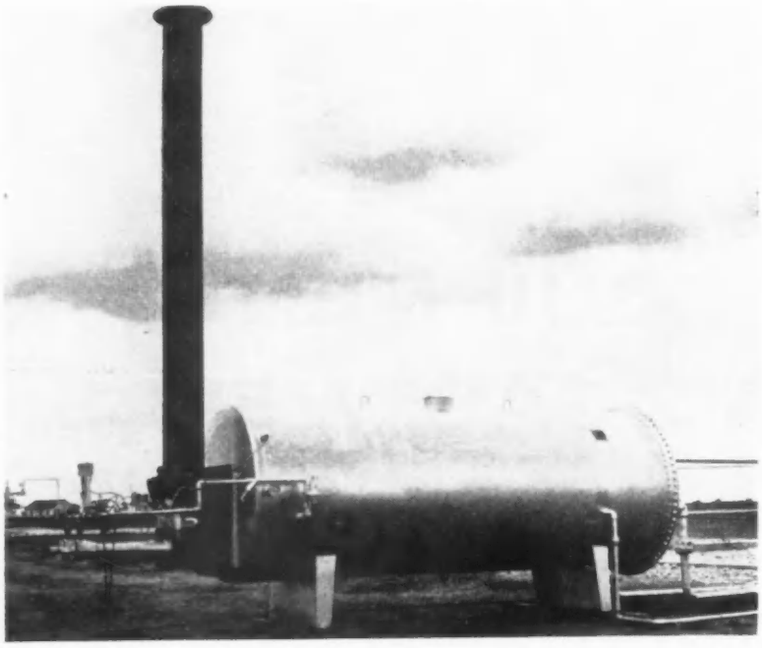
- Installed on the flow line upstream of the pressure reducing choke on low temperature separation units (See Part 2, January 1960 WORLD OIL).
- Used in conventional stage separation hook-ups.
- May be installed upstream of short cycle hydrocarbon recovery units to maintain constant inlet gas temperatures.
- May be used upstream of glycol dehydration units.

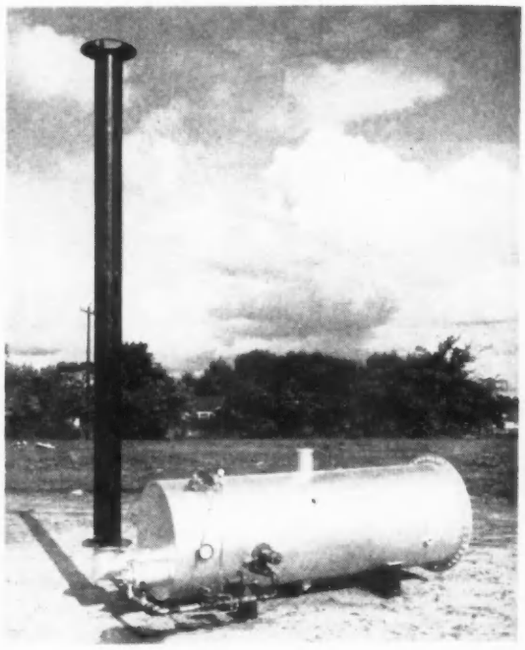
Basic parts of the indirect heater are the flow coil, firebox and shell. The heater is normally a horizontal vessel mounted on steel saddles or skids. Water is used to transfer heat from the firebox to the flow coil. The heating tube is mounted in the lower segment of the vessel and the coil in the upper portion (Figure 1).

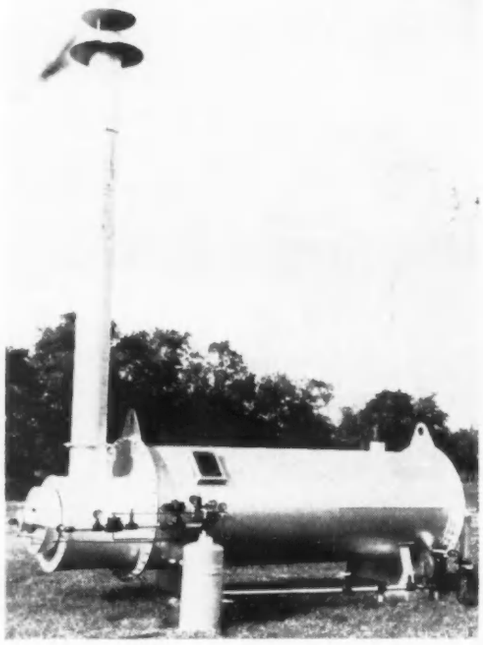
The coil tube size ranges from 1-inch pipe through 6-inch pipe, depending on heater size. The tube bundle usually is arranged so that it may be divided into two or more separate coils in case it is desired to flow more than one gas stream through the same heater.

Pipe or plate is used in the fabrication of the heating tube. The heat transfer rate varies from about 9,000 to 15,000 Btu/ft.^{2} of heating tube surface. The stack fur-

Various types of fireboxes, coils and interior shell designs are used in indirect line heaters . . .







Here are several different types of indirect line heaters. Although similar in construction, note that fireboxes are designed in several different shapes.

nishes the draft necessary to pull combustion products through the heating tube. The stack diameter and length is best determined by experiment to give the highest efficiency for a particular heating tube design.

Fuel gas for the burner is usually obtained from a 1,000 psi or lower pressure source. Pressure reducing regulators of 1-inch pipe size and 1,000 psi maximum inlet pressure are ample in most cases, and are less expensive than a pilot operated reducing regulator.

Two reducing regulators are used in series when fuel gas supply pressure exceeds about 200 psi. One regulator will reduce the pressure to about 100-150 psi and the second regulator will provide fuel gas at burner operating pressure. The burner pressure may be set as low as 5 psi

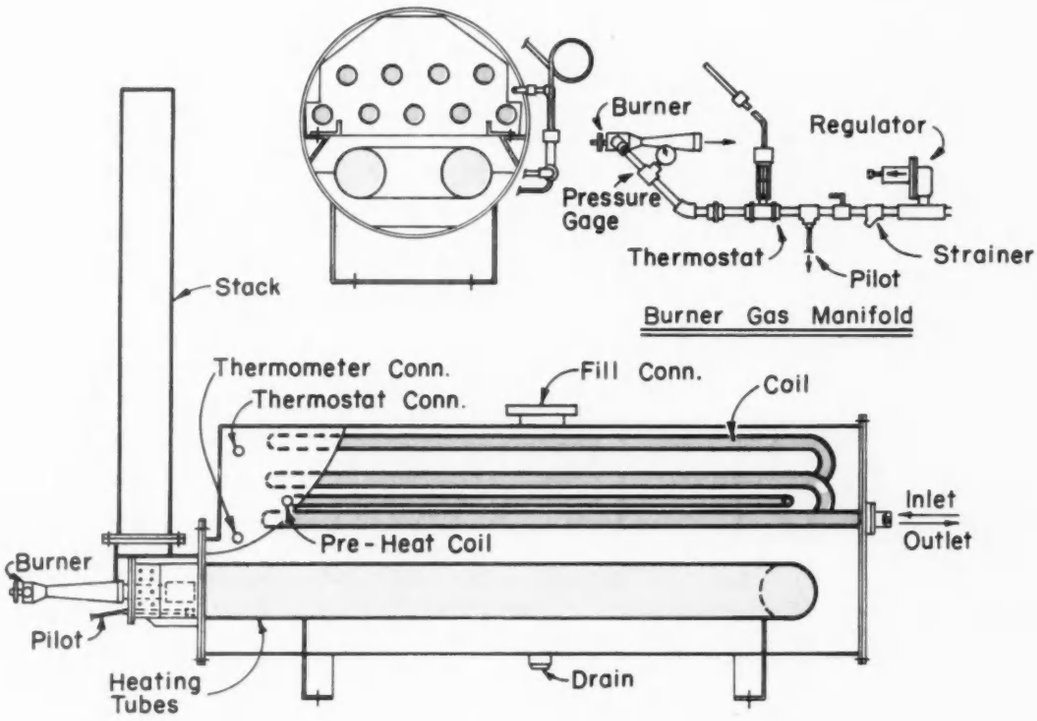


FIGURE 1—Schematic diagram, indirect line heater.

when the temperature control valve is in the full open position and at higher pressures depending on the particular design.

The temperature controller is located downstream from the reducing regulators and controls the volume of gas to the burner. Normally, 190° F is the maximum temperature recommended for the water bath. Proper selection of the water bath temperature will prevent over-heating of the gas stream and reduce operating expense.

The burner is so positioned that the products of combustion are effective on the entire length of the heating tube. The raw gas is first mixed with air prior to entering the burner. This primary air furnishes a large percentage of the total air required for complete combustion. Additional air required is supplied by the secondary air adjustment. With proper size burner orifice and supply gas pressure, the flame should be blue or blue-orange in color. Also, the flame should be on, or nearly on, the burner tip.

The pilot is located near the burner. To insure the pilot a continuous supply of gas, its source is located upstream from the temperature controller. A fuel gas strainer is placed upstream from the temperature controller and pilot supply connections. This prevents foreign particles from clogging orifices or lodging on the seat of the temperature controller. Liquids are also collected in the lower portion, thus, the strainer should be drained and cleaned periodically.

The shell is designed to operate at atmospheric pressure. Dimensions of the shell are held to a minimum thus reducing both the quantity of heating medium required, and heat loss to the atmosphere. Cover plates for the coil and heating tube are sealed tight to the shell to prevent leakage of the heat transfer medium. The fill cap serves as a liquid expansion chamber in addition to providing a surface for condensation of water vapor.

The submerged or long nose choke (Figure 2) may be used on the inlet to the indirect heater coil. Its function is to increase the temperature difference between the gas and water, and thus a larger mean temperature difference can be used in calculations. Since the choke is immersed in the hot water bath at the point of pressure reduction,

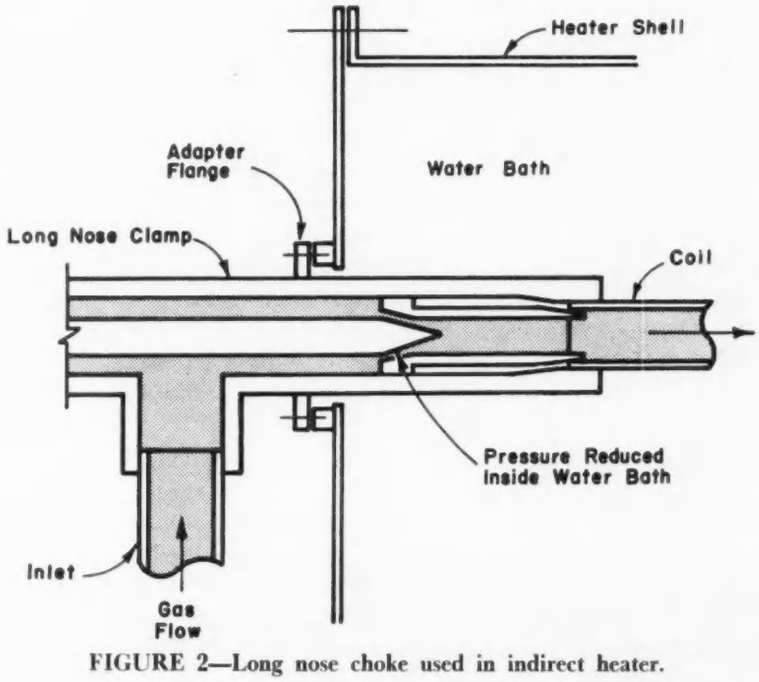


FIGURE 2—Long nose choke used in indirect heater.

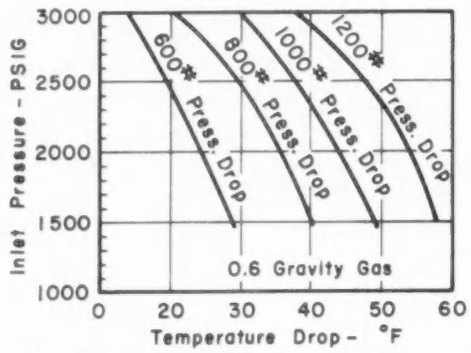


FIGURE 3—Temperature drop of 0.6 gravity gas due to pressure drop.

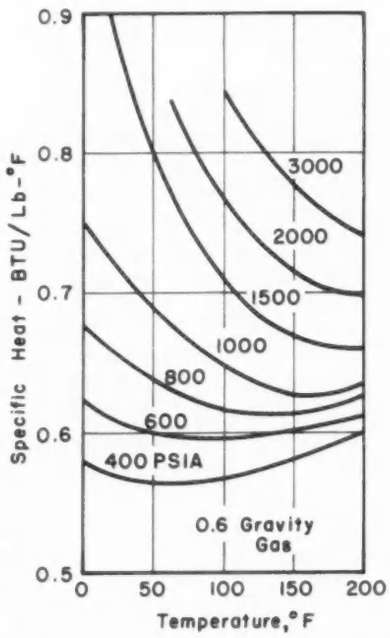


FIGURE 4—Specific heat values for 0.6 gravity gas at various pressures and temperatures.

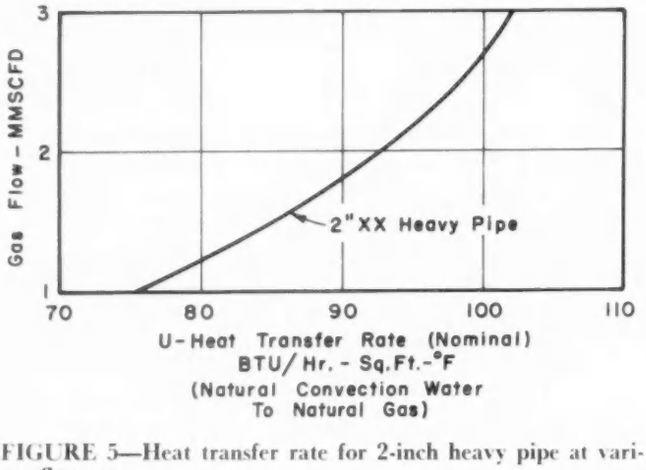


FIGURE 5—Heat transfer rate for 2-inch heavy pipe at various flow rates.

the heated choke body and coil prevent hydrate formation.

In order for the water bath heat to reach the gas in the tube bundle, it must penetrate several resistances to heat flow: the water film on the exterior surface of the flow pipe; the pipe wall and the inside gas film. The overall heat transfer resistance is a combination of these three heat transfer resistances. These resistances depend on many factors: specific heat, density, viscosity, temperature of the gas and water, flow rates of the gas, tube wall thickness and conditions of the tube surface.

The indirect heater should be inspected periodically to insure maximum performance. Scale on the heating tube and coil bundle lowers the heat transfer rate and should be removed. The water bath must cover all of the coils and its level is easily inspected through the fill connections. If liquid collects in the fuel supply gas line, it is advisable to use a liquid trap upstream from the reducing regulator to avoid burner and pilot malfunctions.

Water for the heating medium should be as pure as possible and free of dirt, sand or other foreign material. Proper burner adjustment will save valuable fuel.

Problem example. In many cases, indirect line heaters are not engineered for the job. The following example illustrates one method used to determine proper heater size for a given application.

It is required to reduce 2,000,000 scfd of 0.6 gravity gas from 2,200 psi and 70° F to 1,000 psi without forming hydrates. Assume 2 inch extra heavy pipe is used in the coil and water bath temperature = 185° F. Calculate the heat load and coil area required.

1. Quantity of heat required, Q:
   a. Temperature drop due to pressure drop of 1,200 psi from Figure 3 = 52° F.
   b. At 1,000 psi, hydrates will form at 61° F (From N.G.S.M.A. Engineering Data Book, P. 109, 1957).
   c. Temperature safety margin is assumed as 10° F.
   d. Outlet temperature required = 52° F + 61° F + 10° F = 123° F.
   e. Temperature rise through the heater = 123° F — 70° F = 53° F.
   f. Average temperature of gas flowing in heater = $\frac{123 + 70}{2} = 96.5°$ F.
   g. C_p, Specific heat of gas at 2,200 psi and 96.5° F. (Figure 4) = 0.79 Btu/lb. — °F.
   h. ρ_g, Density of 0.6 gravity gas = (0.6) (0.0748) = 0.0449 lbs./Ft.^{3}
   i. Q, Heat Required, Btu/hr. = $\frac{\text{SCFD}}{24}$ (ρ_g) (C_p) (Temperature Rise)
   $= \left(\frac{2,000,000}{24}\right)$ (0.0449) (0.79) (53)
   = 157,000 Btu/hr.
2. Coil Area Required:
   a. U — Over-all heat transfer rate (Figure 5) = 93 Btu/hr — Ft.^{2} — °F.
   b. $\triangle T = \frac{\text{GTD} - \text{LTD}}{\text{Log}_e \frac{\text{GTD}}{\text{LTD}}} = \frac{115 - 62}{\text{Log}_e \frac{115}{62}} = 86.1°$ F.
   c. Coil Area Required
   $A = \frac{Q}{U \triangle T} = \frac{157,000}{(93)\ (86.1)}$
   $A = 19.7$ Ft.^{2}
3. Under steady flow conditions, the heater selected must have a heating tube rating of at least 157,000 Btu/hr. and a minimum coil area of 19.7 ft.^{2} The highest flow rate in a given period of time must be used as the basis for calculations.

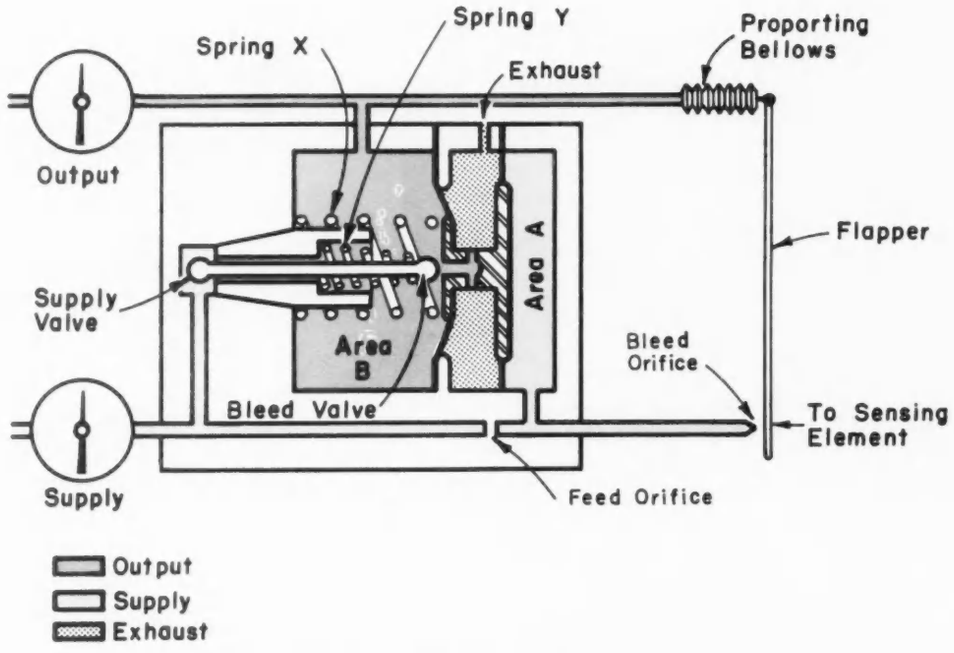


FIGURE 1—Typical field controller power element.

9. FIELD INSTRUMENTATION AND CONTROL OF OIL AND GAS WELL PRODUCING EQUIPMENT

By James Fowler, Engineer,
Climax Division of Black, Sivalls & Bryson, Inc., Houston

INSTRUMENTATION AND CONTROL in oil and gas producing operations has advanced rapidly over the past few years. Initially, all field control was manual. However, automatic devices now control the flow of oil and gas from wellhead to refinery.

Three basic types of control are used on field producing equipment: pressure, temperature and level. Although many separate items are used to achieve this control, they may be further classified as controlling instruments, control valves and self-contained regulators.

INSTRUMENTS AND CONTROLS

There are two major parts to most oil field controllers: a power element and a sensing element. The power element translates changes into a controlling signal, and the sensing element senses physical change in condition.

Power element. Most power elements in use today are similar in construction. Although some simple units utilize a flapper and adjustable magnet to close a bleed orifice and "snap" actuate a control valve, power relays are used in most advanced controllers. A typical power unit is shown in Figure 1.

Referring to Figure 1, the supply medium (gas or air) flows through the feed orifice, both into Area A and out of the bleed orifice. The constant escape of supply gas through the bleed orifice keeps the pressure in Area A low, allowing Spring X to keep the bleed valve open. The

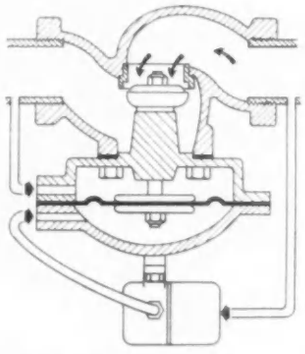


FIGURE 2—Low pressure dump valve.

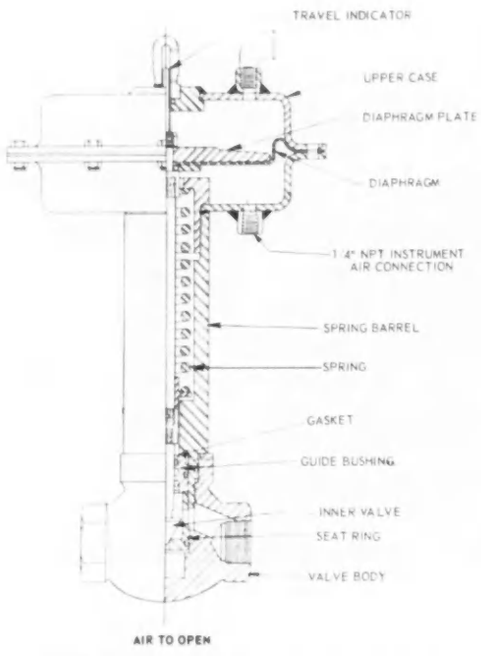


FIGURE 3—High pressure dump valve.

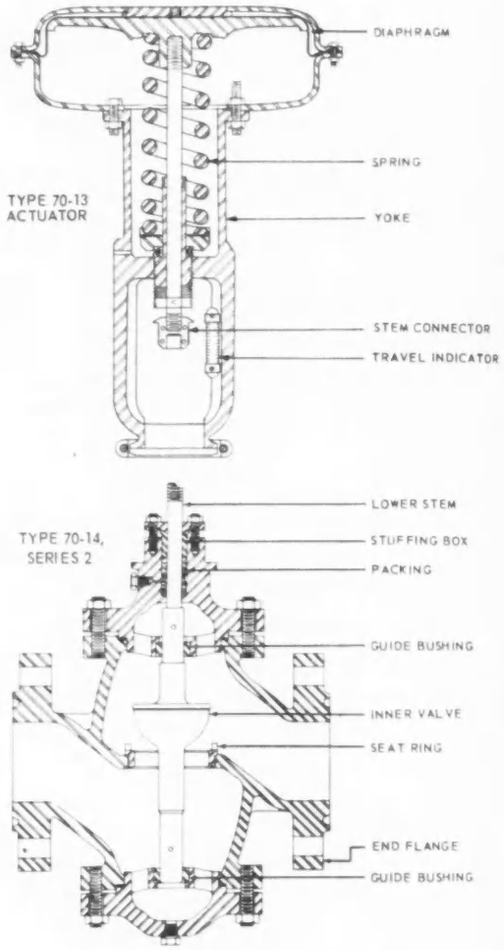


FIGURE 4—Throttling valve.

sensing element positions a flapper through a mechanical linkage, restricting the flow through the bleed orifice and causing pressure in Area A to vary proportionally to the sensing element movement. An increasing pressure in Area A overcomes Spring X, closing the bleed valve. A further increase in pressure depresses Spring Y and opens the supply valve. The supply medium then passes through the supply valve to the diaphragm of the control valve.

There are two basic types of controllers: the snap acting or off-on type which puts out only a maximum or minimum signal, and the proportional type.

A proportional controller moves the control valve gradually from one position to new positions to maintain a desired control point. The controller signal is "proportional" to the relationship between the desired control point and the measurement variation under control. One hundred percent proportional setting would mean that the controlled variable would have to vary the complete sensing element range to move the control valve from full open position to the completely closed position.

In addition to the power element described previously, a force balance or strain gage type pilot also is available for level control service. This type element utilizes force instead of motion to cause a change in pilot pressure and operate a liquid valve. Thus, only a very small movement in the torque tube sensing element (see below) is required to activate the pilot. This type element does not bleed gas to atmosphere and may be used in either snap acting or throttling service.

Sensing element. Various sensing elements will control pressure, temperature and level.

Pressure sensing elements include bourdon tubes, bellows and differential bellows. As an example, a bourdon tube tends to straighten as pressure increases and will return to normal as pressure decreases. Thus, the tip travel of the bourdon tube is transmitted mechanically to the power unit which operates the control valve.

Level control sensing elements include ball floats, displacement elements and bourdon tubes and bellows to sense liquid head. Level controls using ball floats transmit movement to a power element or mechanically operated valve through a packing gland or torque tube.

Displacement elements are used with displacement type torque tube level controllers. The element sinks in the controlled liquid and becomes lighter proportional to the weight of liquid displaced. The lighter displacement element will rise due to the preset torque in the tube. As the float rises, the rod in the center of the torque tube turns. This rotation then is mechanically linked to a power unit which operates as described previously.

Differential level control is obtained by measuring liquid head at operating pressure. This is done by using a closely calibrated spring on the lower pressure (gas) side of a diaphragm or bellows arrangement. The common unit now in use operates in the following manner:

Pressure (gas + liquid head) from the lower portion of the vessel is transmitted to the unit and acts against one side of a diaphragm. The opposite side of the diaphragm is subjected to pressure (gas only) from the upper portion of the vessel. The balancing effect of the gas leaves only the liquid head to overcome the spring and actuate a small three-way valve or power unit which operates the control valve.

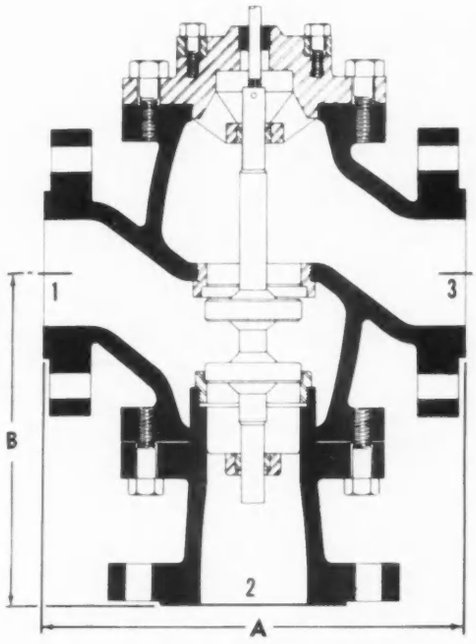


FIGURE 5—Three-way valve.

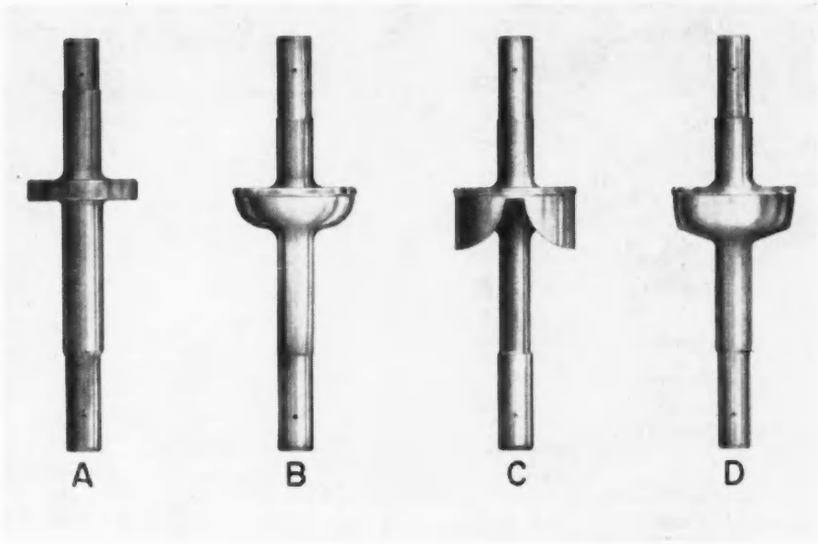


FIGURE 6—Trim used in field control valves.

Temperature control is often lightly considered in the producing industry.Thermostats of the bimetallic coil or rod type which expand or contract with change in temperature are used for most oil field units. The thermostat is directly connected to a valve which either controls the gas stream or controls supply pressure to a motor valve. Thermostats are adequate for most field requirements; however, in many cases a temperature controller is required if a close throttling action must be maintained.

Temperature controller thermal systems normally consist of a thermal bulb, capillary and bourdon tube. Either vapor tension or mercury sensing elements can act as a transfer medium in thermal systems and both types operate similarly. The fluctuation of the sensed temperature expands or contracts the transfer medium causing the bourdon tube to move. This movement is mechanically linked to a power unit which operates as described previously.

Time cycle, flow and differential pressure controllers also are used in producing operations. Description of these controllers are available from the various manufacturers.

CONTROL VALVES

Pneumatic diaphragm control valves are available in a variety of sizes and types. Since these valves are familiar to most field personnel, they will not be discussed in detail; however, several points should be mentioned.

Three general categories of valves are most used in the field: low-pressure dump valves, high-pressure dump valves and throttling valves.

Low pressure dump valves (Figure 2) are widely used on the oil and gas separator. These inexpensive valves are equipped with globe or angle type cast iron bodies and a small diaphragm operator. Seats are normally machined into the body. The inner valve may be constructed of either metallic or composition material. Few of these valves are double ported and most utilize "O" ring type packing.

High-pressure dump valves (Figure 3) normally consist of a screwed, forged steel angle or globe body with removable, hardened stainlesss steel trim. These valves are single ported and usually utilize "O" ring packing.

The throttling valve (Figure 4), which may be equipped with either a forged or cast body, is constructed differently and is more expensive than valves discussed previously. High or low pressure valves in 1, 1½ and 2-inch sizes with relatively low Cv (control valve sizing coefficient) requirements can use forged steel, top-guided bodies. For larger Cv requirements, a cast body is used. Both single and double ported throttling valves are available.

Figure 5 shows a three-way valve which is frequently used in production applications. This type valve is used in positive shut-off as well as throttling service.

Pressure regulators. Self operating regulators are categorized as spring loaded, weight loaded, pilot loaded and pressure balanced.

Spring loaded regulators are equipped with calibrated springs which oppose line pressure across a diaphragm. Springs are normally adjustable and provide a wide operating pressure range.

Weight loaded regulators utilize weights rather than springs to oppose line pressure.

Pilot loaded regulators use the same principal, except a set pressure of supply medium opposes the line pressure. This type regulator may be equipped with a separate or built in pilot.

Combinations of weights or springs also can be used with a pressure balanced regulator to operate in differential service, much in the manner of the differential level controller.

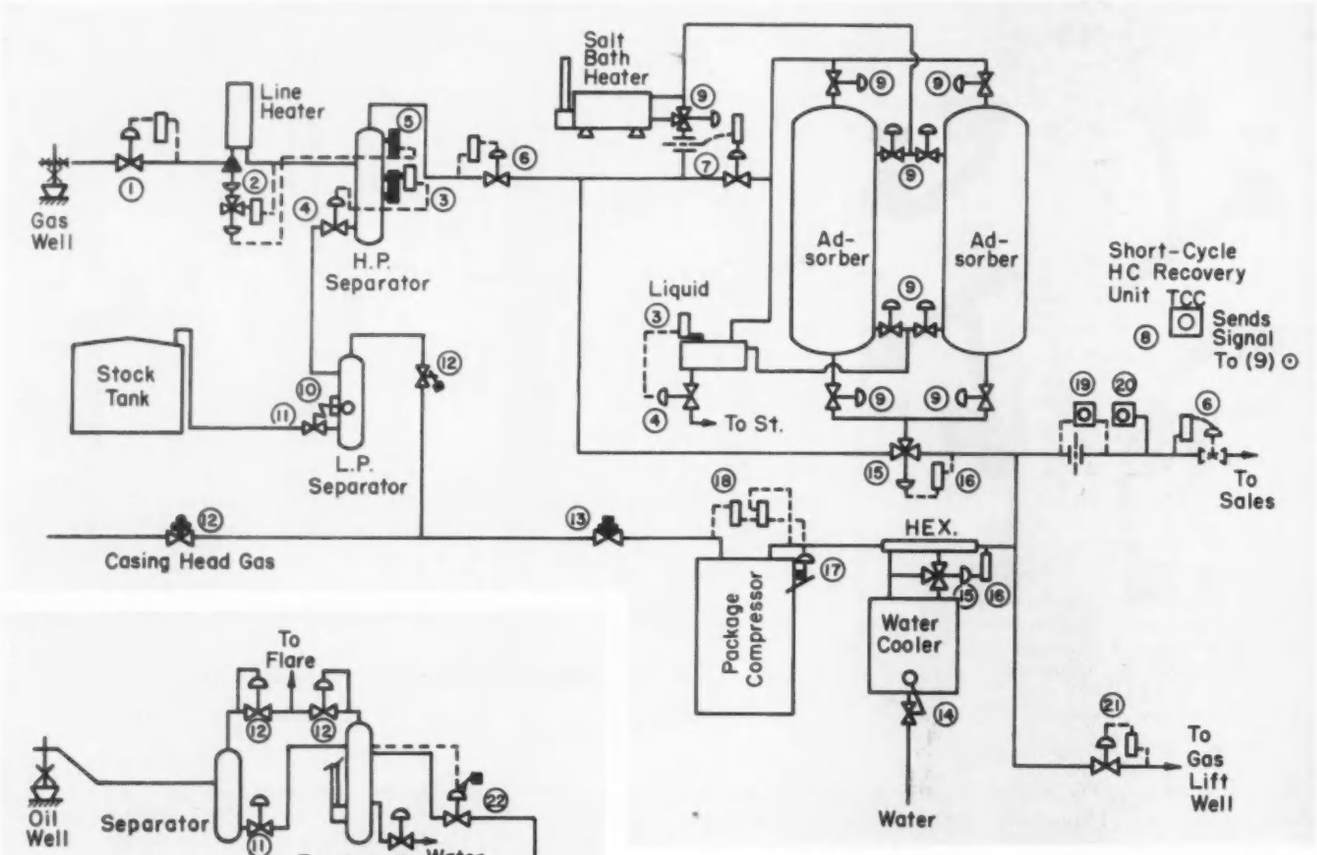


FIGURE 7a—Typical gas well hook-up.

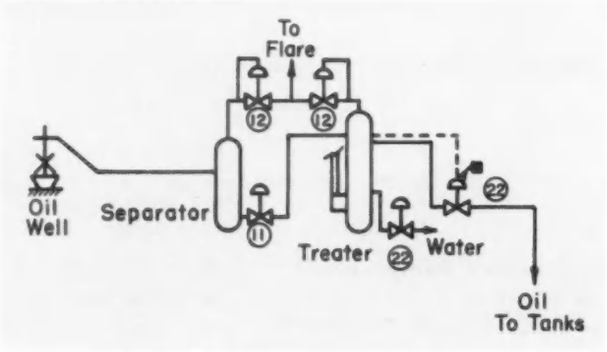


FIGURE 7b—Typical oil well hook-up.

VALVE SELECTION

Instrument engineers estimate that 50 percent of production service calls could be eliminated by proper sizing and application of control equipment. Field equipment is becoming more complicated and newer processes require good control; thus, correct valve sizing is of prime importance. Hit-or-miss methods should not be applied since oversizing destroys the sensitivity of the best instrument, and undersizing will not let desired maximum capacities through the valve.

Flow coefficient tables are available from all manufacturers. The term Cv is used to denote the flow coefficients of control valves and regulators. A Cv of 1 is equal to a flowrate of 1 gpm of 1.0 specific gravity liquid over a 1 psi pressure drop. Actually, the Cv factor tells what the valve will do under an established set of conditions. However, it should be remembered that sizing is no more accurate than the flowing conditions used to compute the size. Following are formulas for sizing valves in liquid, gas and steam. Once the Cv factor has been determined, published charts in manufacturers' catalogs can be consulted for correct valve size. If charts are not available, manufacturers can supply the required information.

Liquid: $Cv = Q\sqrt{\frac{G}{\Delta P}}$

Cv = Flow coefficient
Q = Volumetric flow in gpm
$\Delta P = P_1 - P_2$ = pressure drop across valve
G = Specific gravity at flowing temperature

Gas: $Cv = \frac{Q_o}{963}\sqrt{\frac{GT}{(P_1^2 - P_2^2)}}$

Cv = Flow coefficient
Q_o = Volumetric flowrate in SCFH
T_1 = Inlet temperature, ° F absolute
G = Specific gravity
P_1 = Valve inlet pressure
P_2 = Valve outlet pressure

Note: On gas, critical drop (P_c) is approx. $0.55 \times P_1$. Use P_c for P_2 where P_2 is less than P_c. On steam flow, check for critical pressure curve. Use P_c when less than P_2.

Steam: $Cv = \frac{Q}{63.4}\sqrt{\frac{V_2}{P}}$

Cv = Flow coefficient
Q = Steam flow rate, lb/hr
V_2 = Downstream specific volume
$P = P_1 - P_2$ = pressure drop across valve.

A control valve should be sized for normal flow conditions at various percentages of the rated inner valve travel. (Quick opening trim 20 percent to 50 percent, linear trim 40 percent to 70 percent, equal percentage trim and percentage V trim 50 percent to 80 percent.) A valve which has an inner valve operating too close to the valve seat will wear excessively. Also, sizing the valve too close to full rated travel gives no surge capacity and poor control. At the same time a valve is being sized, trim configuration and material should be considered.

Valve trim frequently is selected carelessly. Characteristic, not material, is the overlooked item. Field personnel have examined and used many different trim materials in their search for an inner valve able to withstand sand, drilling mud, sour gas, etc. High pressure drops further complicate the erosion problem. Although attention should be devoted to material selection, this should not exclude proper application of characterized trim. Normally, trims can be found in characters such as needle, quick opening, linear, equal percent and percent V (Figure 6). Various manufacturers also have special characters and trade names for the above items.

Trim with quick opening character (Figure 6a) is most commonly used in producing operations. Needle valve trim and nominal quick opening trim has this character. The response to quick opening trim is appropriate to its name—about 80 percent of its flow is achieved in the first 40 percent of rated travel. Such trim should be used in all off-on services.

Linear trim (Figure 6b) responds approximately on a 1:1 ratio; that is, at 10 percent open it has a 10 percent total flow, and so on up the scale to 100 percent.

Equal percentage trim (Figure 6d) responds slowly at low flows and faster at high flows. The theory behind this type trim is that at low flow higher lift is required to give flow change, and at increased flow little change in lift gives greater flow; therefore, equal percentage change at percentage of opening. These trims are used in throttling services.

"V" trim (Figure 6c) has a character similar to the equal percentage type. This trim has the greatest rangeability of any type, but is rarely necessary in oil and gas producing operations. Because of its physical construction, V-trim will erode more quickly than other types.

APPLICATION

Figure 7 illustrates the various controls which might be used to operate a lease. Figure 7b is a hook-up for an oil producing lease and Figure 7a shows gas producing equipment. Referring to these flow diagrams, controls used are as follows:

1. *High-low shut-down.* A forged steel valve with quick-opening single seated trim. A pressure pilot closes the valve if the flow line should fail or be subjected to excessive pressure. There are also several types of self-contained high-low safety valves made for this particular service.

2. *Automatic choke.* A diaphragm operator mounted on a choke body with a proportional pressure pilot is used to maintain a pre-set downstream pressure.

3. *Liquid level control—over 125 psi.* Torque tube level controller with either a snap or proportional pilot. A separator which handles a large volume of fluid should utilize a throttling dump.

4. *Dump valve—over 125 psi.* A forged steel globe or angle type valve. For larger flows, a top and bottom or skirt guided valve should be used. The use of a single or double port valve is dependent on size and requirements for tight shut-off. Quick opening trim should be selected for snap acting service and linear or equal percentage trim for throttling service.

5. *High level shut-down.* This service requires either a snap acting torque tube level control or a ball float with a three-way snap pilot valve. This signal would be piped to a three-way pilot valve on the control line of an upstream valve (2).

6. *Gas back-pressure regulator—over 125 psi.* Linear or equal percentage trim should be used in a throttling type valve. In larger sizes, a double port valve should be installed. A throttling pressure pilot is used as the control instrument.

7. *Flow control valve.* In this case, the flow control valve is used in diverting type service. A differential flow controller is used to control either a throttling type valve with linear or equal percentage trim or a butterfly valve.

8. *Time cycle controller.* This particular application requires a controller with two timing dics driven from one clock. One signal switches towers and the other controls the regeneration gas cycle (hot, cool, etc.).

9. *Diverter valves.* These valves must effect a tight shut off. Any valve that can be operated automatically and withstand high regeneration gas temperatures can be used. The normal selection is a single seated top and bottom globe body with quick opening trim.

10. *Liquid level control—125 psi rating.* A ball float operating a mechanical valve or a three-way pilot relay may be used. Also, a differential type controller may be applicable.

11. *Separator dump valve—125 psi.* A mechanical valve may be used in conjunction with a ball float and trunnion. If a pilot relay or differential controller is installed, a low pressure globe or angle, soft seated, diaphragm dump valve would apply.

12. *Back-pressure regulator—125 psi.* Weight loaded, diaphragm loaded, or pilot loaded self-contained regulators are available for this use.

13. *Pressure reducing regulator—125 psi.* Any self-contained regulator, weight loaded, diaphragm loaded, or pilot loaded may be used.

14. *Water make-up valve.* A ball float mechanically linked to a rotary head mechanical valve would be used.

15. *Temperature control valve.* A three-way top and bottom guided valve with equal percentage or percent V trim should be used as a throttling diversionary valve.

16. *Temperature controller.* A proportional temperature controller is recommended.

17. *Engine throttle control.* A bracket mounted diaphragm operator is mechanically linked to the manual throttle in this type service.

18. *Hi-low throttling shut-down.* This hook-up consists of two pressure control pilots piped in series. The first pilot is normally the low pressure sensing unit which slows the engine on low suction and shuts the engine at a predetermined setting. The output of this pilot is piped to the supply of the high pressure shut down. Since the high pressure shut-down pilot can only yield an output equal to its supply, the first pilot controls if discharge pressure is correct. If the suction pressure is in the proper range, the low pressure shut-down pilot provides the high pressure shut-down pilot with an adequate volume of supply gas, and the high pressure pilot becomes the controlling instrument.

19. *Flow recorder.* A differential bellows or mercury filled differential orifice meter driven by a clock is used to measure the flow of gas.

20. *Temperature recorder.* A clock or pneumatic wound chart drive with a temperature sensing record pen.

21. *Gas lift intermitter.* A clock wound time cycle controller with one snap acting output signal operates a

forged steel globe valve with top or stem guided quick opening trim.

22. *Treater oil and water valve.* A self contained regulator which utilizes a combination pressure balanced diaphragm and adjustable spring or weight acting against the top of the diaphragm to oppose the liquid head.

TROUBLE SHOOTING AND MAINTENANCE

Automatic control equipment is responsible for the ease of operation and most of the safety in producing operations. But it is also true that this same equipment causes more trouble than any other phase of lease production. Locating trouble spots is a matter of following the control loop, checking each item in sequence.

Instruments. Supply gas for control is normally taken directly from the gas section of vessels or directly from gas flowlines. As a result there is little clean supply medium available as a power source for control equipment. Frequently, this gas is reduced from a relatively high pressure which increases the possibility of hydrates forming in the supply lines.

In case of failure, the supply should be checked first. This may be done by bleeding the supply gas filter which is installed with every instrument. This filter should be bled frequently. If gas escapes freely, the supply system is working properly. If malfunction comes and goes, particularly at night in cold weather, hydrates in the supply system probably are causing the trouble.

If the supply system operates properly, the instrument should be checked. Manual movement of the sensing element will actuate the unit. Thus, it can be determined if the instrument is operating properly. An excess of liquid in the filter indicates that the relay is loaded with fluid and should be cleaned. All linkages should be checked to see that they are free to move properly.

If no fluid is in the relay and all linkages are free, foreign material may be stopping one of the small orifices. This can only be remedied by dismantling and cleaning. While apart, all diaphragms and gaskets should be checked. Frequently cleaning of the relay will solve the problem although no specific discrepancies have been found.

Generally, sensing elements are not troublesome. In case of malfunction, the connecting linkage should be checked first. Frequently, a loose connection will make the instrument inoperative or inaccurate. Pressure element failures are readily visible as they will either leak or be distorted. Temperature elements are also subject to distortion and thermal system leakage is a possibility.

Level sensing elements are more complicated. The first check should be the torque tube or similar connecting link. Loss of torque is often a problem. Some torque tubes are present while others are adjustable. In case of failure of the preset type, it must be replaced; the adjustable tube can be reset. In units where packing glands are used, seizure in the linkage is a possibility.

Floats are always subject to leaks. When a leak in one of these units occurs, it loads with fluid and is rendered useless.

Control valves. Most control valve trouble occurs in three places: the diaphragm spring combination, guides and trim. Listed below are a few symptoms and possible solutions:

Air to diaphragm—no stem travel. This could be caused by diaphragm failure, stem galled in guides, or unbalance across the inner valve. Unbalance can easily be determined by taking the valve out of service. If the stem can be moved, unbalance is the trouble. The valve is always in the closed position with flow on top of the inner valve when this happens. To correct, inner valve size is decreased. Increased spring tension will help in case of normally open valves and decreased spring tension in the case of normally closed valves. If this fails, a larger diaphragm would be required.

Galling in guide bushings is common. This is caused by foreign material forcing the guide to gall on one side. This usually can be corrected by smoothing the guides and inner valve guiding surface.

Inner valve cycling. Cycling is usually caused by dynamic unbalance. Ordinarily, this is caused by an oversized valve. If the valve is oversized, pinching a valve downstream should stop the cycling. Increasing spring tension and/or changing the position of the inner valve can sometimes remedy the situation. Otherwise, a smaller valve may be required.

Excessive leak through valve. There can be many reasons for valve leakage, but the most common cause is eroded trim. Another possibility is that the inner valve has twisted, the stem raising the inner valve away from the seat in spring closed valves. An increase in design pressure drop and less diaphragm force will help the valve open.

Self contained regulators have the same potential trouble spots as control valves and similar checks should be made in case of regulator failure.

Butterfly valves have a unique problem not incurred anywhere else. The diaphragm operator is the same as that used on a control valve; however, on resilient seated valves there is the problem (usually on original installation) that the seat may be pushed up by the flanges and will interfere with disc rotation. The valve thus will have to be broken out and re-installed.

Because of the many factors involved in field control and instrumentation, this section of the Production Practices Manual has necessarily been general in treatment of the subject. However, basic information which is directly applicable to field problems has been included. It is felt that the application section of this article will prove especially valuable to field personnel engaged in design and layout of oil and gas producing equipment. Most controls used in producing operations are included on the schematic flow diagrams.

For more detailed information on the subject, the reader is referred to the many manufacturers who produce this equipment.

Due to circumstances beyond the control of WORLD OIL, Part 10 of the Production Practices Manual could not be included in this issue. This final installment will appear in a subsequent issue.

Cotton Valley discoveries spur deep pay search in East Texas Basin

Buckner and Smackover limestone seen as flank objectives beneath East Texas Basin's truncated unconformities

By Joseph A. Kornfeld, President
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RECENT DISCOVERY OF commercial quantities of natural gas and distillate from the Jurassic Cotton Valley sandstone series near Fruitvale in Van Zandt County, Texas, suggests one of the new formation objectives sought in the current search for deep hydrocarbon reserves within the East Texas basin.

While the Cotton Valley sandstone development within the East Texas basin lies just on the threshold, there are other related formation objectives sought in exploration of high-relief, truncated, faulted prospects lying within the down-dip Jurassic belt extending throughout Van Zandt, Rains, Wood, Franklin, Hopkins, Camp, Morris and Cass counties, East Texas.

The Fruitvale prospect itself marks the first Cotton Valley hydrocarbon production found within the East Texas basin proper. Other Cotton Valley production lies in the Linden field of southern Cass County, Texas, about 100 miles to the east and in the Waskom pool of Harrison County, Texas, as well as throughout southern Arkansas and North Louisiana.

While the amount of net hydrocarbon pay zone in the new Fruitvale prospect itself is limited to only 20 feet of thickness from 10,522-10,542 feet, and has drill-stem tested natural gas and some distillate, it points up re-evaluation of Cotton Valley sandstone sections that may be present over or flanking known structural anomalies within the basin proper. Other basin objectives include the Upper and Lower Rodessa limestones, the James limestone, the Pettit limestone, the Travis Peak sandstone, the Buckner limestone and the Smackover limestone.

Correlation of Formation Markers, Fruitvale Townsite Area, Van Zandt County, East Texas Basin
(All Formation Determinations Prepared from Electric Log Surveys)

Formation Markers	*R.J. Caraway, Pan-American Petroleum Corporation W.A. McCoy No. 1 Jas. Chesire Sur. A-181 Elevation: 496 Ft. d. f.		†R.J. Caraway Et Al O.L. Happonstall No. 1 J. Marrs Sur. A-565 Elevation: 485 Ft. d. f.	
	Depth	Datum	Depth	Datum
Upper Cretaceous:				
Nacatoch Sandstone	1,558	(—1,062)	1,552	(—1,067)
Pecan Gap Chalk	2,380	(—1,884)	2,390	(—1,905)
Austin Chalk	.....	.....	3,516	(—3,031)
Base Austin Chalk	3,930	(—3,434)	3,930	(—3,445)
Sub-Clarksville Formation	3,972	(—3,476)	3,950	(—3,465)
Woodbine Sandstone	4,400	(—3,904)	4,427	(—3,942)
Lower Cretaceous:	5,215	(—4,719)	5,217	(—4,732)
Buda Limestone	5,250	(—4,754)	5,257	(—4,772)
Del Rio Shale	5,407	(—4,911)	5,390	(—4,905)
Georgetown Limestone	5,470	(—4,974)	5,477	(—4,992)
Maness Shale	5,562	(—5,066)	5,570	(—5,085)
Denton Formation	5,761	(—5,265)	5,778	(—5,293)
Fort Worth Limestone	5,870	(—5,374)	5,883	(—5,398)
Duck Creek Shale	6,048	(—5,552)	6,056	(—5,571)
Duck Creek Limestone	6,168	(—5,672)	6,180	(—5,695)
Kiamichi Formation	6,270	(—5,774)	6,281	(—5,796)
Goodland Limestone	6,322	(—5,826)	6,339	(—5,854)
Paluxy Sandstone	6,400	(—5,904)	6,413	(—5,928)
Glen Rose of Texas	6,730	(—6,234)	6,750	(—6,265)
Glen Rose of Louisiana	.....	.....	7,300	(—6,815)
Massive Anhydrite	7,790	(—7,294)	7,835	(—7,350)
Base Massive Anhydrite	7,970	(—7,474)	8,085	(—7,600)
Pettit Formation	8,584	(—8,088)	....	.....
Jurassic System				
Cotton Valley Sandstone	10,522	(—10,026)	NR	NR
Cotton Valley Limestone	11,568	(—11,072)	NR	NR
Salt Stringers	12,044	(—11,548)	NR	NR
TOTAL DEPTH	13,563	(—13,067)	8,913	(—8,428)

* Well description: 660 feet from the south line and 2,225 feet from the north line, and 2,115 feet from the west line of the James Chesire Survey, Abstract No. 181 triple completion discovery well of the Fruitvale Townsite field. Commenced: July 27, 1959.

† Well description: 467 feet out of the southwest corner of the O.L. Happonstall 30-acre tract, and 467 feet from the easterly south line and 2,250 feet from the easterly east line of the J. Marrs Survey, Abstract No. 565 D & A. Completed: February 26, 1955.

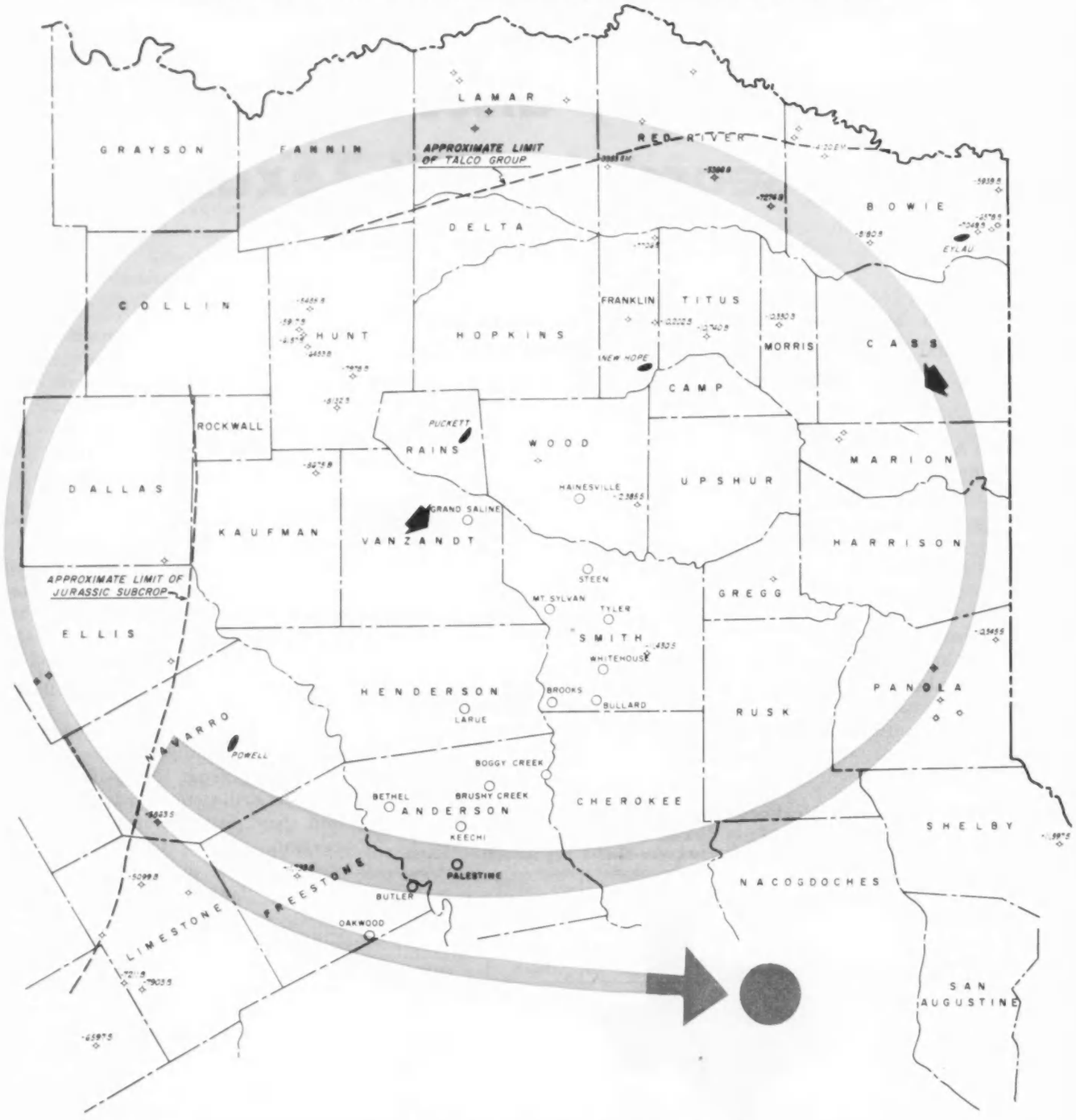
DEEP-SEATED SALT DOME PROVINCE

Structure of the Fruitvale prospect is suggested by drilling to be that of a truncated, faulted deep-seated salt dome. Two interesting geologic conditions are:

1. Truncation of the interval from the Upper Cotton Valley series including the Buckner series, Smackover formation and pre-Smackover section from the crest of the structure.

2. Penetration of the basement salt section for an interval of more than 1,568 feet below 12,000 feet where salt was encountered.

Where East Texas' Cotton Valley Discoveries Are Located



East Texas Basin geologic features shown above include location of piercement-type salt domes, west up-dip subcrop of Jurassic sediments and north subcrop limits of Talco group sediments. Arrow in Van Zandt County points to location of the new Fruitvale gas-distillate discovery in the Cotton Valley, while the arrow in Cass County points out the Linden field discovery in the Cotton Valley, located about 100 miles east of the Fruitvale well.

The Fruitvale prospect marks the third deep-seated salt dome mapped within the East Texas basin in which marked truncation and/or faulting has been encountered. Other prospects in which this geologic condition have been observed include Quitman dome in Wood County, and Ginger dome in Rains County, Texas. In all of these three prospects, basement salt has been intruded causing truncation of the Smackover formation from the crest of the local structure.

Structure of the Fruitvale prospect reflects about 100 feet of structural closure as mapped on the base of the Austin chalk of Upper Cretaceous age, and an estimated 600 to 700 feet as mapped on the top of the Jurassic Cotton Valley formation. This intensification of structural relief with depth in the pre-Cretaceous beds is significant from a geological exploration viewpoint.

Moreover, the high relief of these pre-Cretaceous anomalies is significant from an exploration standpoint in that hydrocarbon reservoirs may exist around the rims of these deep-seated salt domes lying at high angles in the Buck-

ner and Smackover objectives, but complicated with radial and possible peripheral fault patterns.

An analogy may be made to certain geological case histories lying within the Gulf Coast salt dome province where regional sandstones produce only on the flank of truncated, piercement-type salt domes.

The Fruitvale prospect was originally scheduled as a Rodessa formation project based on geophysical data. However, commercial oil production was indicated by drillstem tests conducted on the Upper and Lower Rodessa formation, the James limestone and in the Cotton Valley before encountering salt in attempting to find the Smackover formation objective.

Discovery operators are R. J. Caraway, Dallas, and Pan American Petroleum Corporation's W. A. McCoy 1, located in the J. A. Cheshire survey, Abst. No. 181. Location of the well is slightly less than a mile southeast of Fruitvale and about four miles northeast of the Fruitvale field which also was discovered by R. J. Caraway and Three States Natural Gas Company of Dallas, Texas.

Originally, the W. A. McCoy 1 was drilled to a total depth of 13,568 feet in basement salt encountered at 12,000 feet. All possible hydrocarbon reservoirs were put behind a string of 7-inch production casing set and cemented at 12,096 feet.

DRILLSTEM TEST DATA

Cotton Valley formation. Original drillstem test evaluation of hydrocarbon porosity in the Cotton Valley formation was made on interval from 10,522-10,532 feet. On drillstem test, it flowed gas at the rate of 2,170,000 cubic feet daily through 12/64-inch choke with 2,800 psig final flowing pressure. The zone also made an ungaged amount of high-gravity condensate. The gas is sweet as contrasted to the high sulfur character of the Smackover limestone of the East Texas basin.

James limestone. Drillstem evaluation of the James limestone porosity interval from 8,286-8,293 feet was at the rate of 200 barrels of oil per day. Final flowing bottom-hole pressure was 225 psig, and final shut-in bottom-hole pressure was 1,650 psig.

Upper Rodessa formation. Drillstem test evaluation of the productivity of the Upper Rodessa formation was made of porosity interval from 8,184-8,194 feet. Initial flow rate was 300 barrels of oil per day through ¼-inch choke. Final flowing bottom-hole pressure was 300 psig.

About the Author

Joseph A. Kornfeld is president of Kornfeld International, consulting petroleum technologists, Tulsa. He has widespread international experience in geological and engineering studies of exploration and production operations. Kornfeld is a faculty member of the School of Gas Technology sponsored by the Petroleum Extension Service of The University of Texas. He has lectured at the Algiers and Mexico City sessions of the International Geological Congress during 1952 and 1956, and at the Paris and Munich conferences of the International Convention on Pure and Applied Chemistry during 1957 and 1959.

POTENTIAL TESTS

Lower Rodessa formation. Early in January 1960, the discovery well was completed through perforations, 8,286-8,293 feet in the lower Rodessa formation. On initial potential test, it was rated at 399 barrels per day of 42.4 degree API oil produced through ¼-inch choke. Initial produced gas-oil ratio was 1,120 cubic feet of gas per barrel of oil.

Upper Rodessa formation. Early in February 1960, the discovery well was completed through perforations, 8,184-8,194 feet in the Upper Rodessa formation. On initial potential test, it was rated at 114 barrels per day of 42 degree API oil produced through an 18/64-inch choke. Initial produced gas-oil ratio was 2,889 cubic feet of gas per barrel of oil.

Cotton Valley formation. At this writing, operators were waiting for additional storage room before conducting potential tests on Cotton Valley gas reservoir. Originally, operators logged 20 feet of hydrocarbon porosity from 10,522-10,542 feet in the Cotton Valley.

Support for these deep tests was contributed by Shell Oil Company, The Atlantic Refining Company and Amerada Petroleum Corporation. The contractor for the discovery well at Fruitvale was M. J. Delaney Co., Dallas.

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Watch for a complete roundup of exploration developments in your April issue of WORLD OIL

Kerr McGee's Rig 46 on location in Timbalier Bay field of Louisiana.

How to drill 10,000 feet in four

High bit weights, fast rotary speeds and high rig personnel efficiency all attributed to this record drilling performance

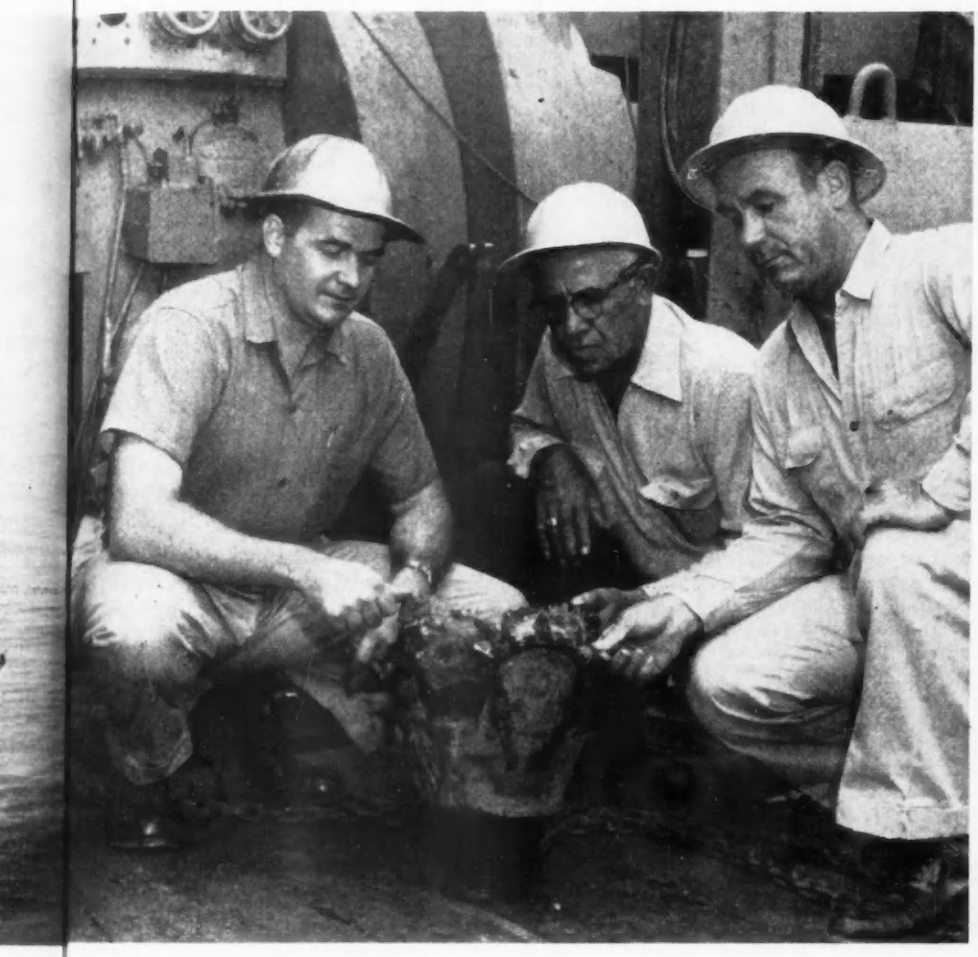
By Virgil C. Stone
Area Drilling Foreman
Gulf Oil Corp., Morgan City, La.

GULF OIL CORPORATION recently drilled an offshore well from spud to 10,000 feet in 4 days, 22 hours. This well was located in Block 21 offshore from the Timbalier Bay field in Louisiana. Kerr-McGee Industries Rig 46 was the contractor on the well. The work was performed on a day-rate contract.

Although fairly good penetration rates previously have been obtained in this area, drilling to the depth of 10,000 feet in less than five days has occasioned some interest. Lithology in this area is interbedded sands and shales of the Miocene origin.

Gulf Oil Corporation has been making continuous improvement in the over-all drilling program in this area, and, because of the extensive field development program that has been initiated, a valid comparison in drilling practices is possible.

With full cooperation of rig personnel, several new ideas of present



Ray H. Gross (left), Gulf drilling engineer, and Dave Jones (center) and E. J. Richard, Kerr McGee toolpushers, observe condition of dull bit that has just been pulled.

days and 22 hours

drilling practices were put into use and were largely responsible for the improved over-all performance.

These practices included:

- Maximum efficient hydraulic program (400 feet per second jet velocities)
- Exceptionally high bit weights (80,000 to 100,000 pounds)
- Exceptionally fast rotary speeds (150-300 + rpm)
- Decreasing waiting on cement time
- Eliminating slope tests while drilling
- Eliminating reaming to bottom before new connection
- Keeping sand content of drilling mud very low (2 percent and less)

Drilling program. A 30-inch conductor pipe was driven to approximately 150 feet to a firm landing. Blowout equipment then was installed and tested. A 15-inch hole was drilled to 2,500 feet, where 10¾-inch surface pipe was set and cemented.

Blowout equipment was installed and tested again. The equipment was tested to 5,000 psi before drilling

The Timetable

Here's a breakdown of the daily drilling log from spud at 0500 the first day to 10,000 feet at 0248 the sixth day.

First Day

0700-1200 Drove drive pipe to 158'.
1200-2200 Nippled up 20-inch blowout equipment.
2200-0200 Picked up 12—7¾-inch drill collars and 15-inch bit.
0200-0500 Tested blowout equipment and drill pipe.
0500-0700 Drilled to 370 feet. Layed down 8 joints of drill pipe. Ran in 9—7¾-inch drill collars (SPUDDED IN 0500).

Second Day

0700-1200 Drilled surface hole to 2542 feet.
1200-1400 Circulating. Rigging up to run 10¾-inch surface casing.
1400-1600 Ran 62 joints to 10¾-inch surface casing.
1600-1700 Installed cement head and circulate.
1700-2000 Cemented surface casing.
2000-0200 Nippling up.

Third Day

0700-1300 Nippled up.
1200-1500 Tested casing and manifold.
1500-2200 Test BOP.
2200-2300 Going in hole with bit to drill ahead.
2300-2400 Drilled float shoe (30 feet of cement).
2400-0100 Drilling.
0100-0200 Packed swivel.
0200-0700 Drilled to 4300 feet.

Fourth Day

0700-1300 Drilling.
1300-1400 Tightened bell nipple.
1400-1600 Drilling.
1600-2100 Round trip for new bit.
2100-0200 Drilling.
0200-0300 Tightened bell nipple.
0300-0500 Drilled to 7510 feet.
0500-0700 Trip for new bit.

Fifth Day

0700-1000 Finished making round trip for bit, cut drilling line.
1000-1500 Drilling.
1500-2100 Drilling.
2100-0200 Round trip for new bit.
0200-0700 Drilled to 9120.

Sixth Day

0700-1300 Drilling.
1200-2000 Round trip for new bit.
2000-0500 Drilling (10,000 feet at 0248).

ahead was resumed. About 24 hours was required to properly nipple up and test blowout equipment. This time was included in the 4 days, 22 hours.

A 9⅞-inch hole was drilled to 11,000 feet where a 7-inch production string was set and cemented. A 6⅜-inch hole was then drilled to total depth and cased with a 5-inch liner. The well then was placed on production.

Drilling equipment included: Diesel electric rig, two 1,000-hp pumps, drawworks powered by two 625-hp electric motors, rotary independently driven with a 625-hp electric motor, an automatic cut-out built into the rotary motor at approximately 465-hp, 5-inch drill pipe, and eighteen 7¾-inch drill collars.

Drilling practices. Approximately 7 hours was required to drill the 15-inch surface hole to approximately 250 feet where eight joints of drill pipe were laid down and nine 7¾-inch drill collars were picked up. This drill collar hook-up was used to finish drilling the surface hole to 2,500 feet.

After the surface casing was set, additional drill collars were picked up, making a total of eighteen 7¾-inch in the drilling string.

The bit weights varied from 60,000-100,000 pounds, with an average of 80,000 pounds being used to the depth of 10,000 feet.

Rotary speeds varied between 150-300+ rpm with the speed never below 150 rpm. A load cut-out built into the rotary table electric motor shuts off the motor, stopping the rotary, when rotary speed exceeds the predetermined cut-out setting, which is about 465 hp. This insures against damage to the rotary table or electric motor.

The drill pipe was inspected visually after each trip for any obvious damage caused by this high speed-heavy weight drilling practice. No damage to the drill pipe was found.

The 1,000-hp pumps, equipped with 7 and 6½-inch liners, were used in parallel while drilling the surface hole. The pump with the larger liners was stroked at 60 spm; the other was stroked at 26 spm. A total volume of approximately 820 gallons per minute was circulated at a surface pressure of 1,600 psi.

After drilling out under the surface string, only one pump was used. This pump was stroked between 55-60 spm and circulated from 560-600 gallons per minute. A maximum surface pressure of 2,200 psi was attained. Long tooth bits with 3 7/16-inch jet nozzles were used.

Cooperation and teamwork of the rig personnel contributed immensely to the over-all time performance. To make a connection required about 1½ minutes. The old conventional procedure before making a connection on past wells was to pick up and ream the joint back to bottom and then pick up and make the connection. However, this specific operation was eliminated and was a contributing factor in decreasing the total time on this well.

Another factor contributing to the over-all time saving practice was the elimination of slope tests. A photo-clinometer test, however, was always taken prior to setting casing to determine the location of the bottom of the hole relative to the surface location.

Another aid in drilling practices was the installation of a back pressure valve in the tubular string to eliminate any back flow in the drill pipe while a connection was being made. In doing this, over-all connection time was decreased.

Can this time be decreased? Although this total time to 10,000 feet appears incredibly fast, it is believed further improvement can be made. Several drilling practices or changes in equipment now are being either tested or planned. It is believed a total savings of 30 hours can be effected through the following changes:

- Nippling up time can be reduced from 24 hours to 8 hours by eliminating the nippling up time on the surface casing. Blowout equipment will be installed on the conductor pipe which will be sufficient to drill to total depth without removing the BOP for a nipple-up job on any subsequent string of casing.
- Drilling with 90-foot rather than 30-foot sections. This should reduce the connection time to a third of the present time. This could result in a saving of approximately 5 to 6 hours.
- Development of increased bit life, thus reducing the trip time. A total of 24 hours was consumed in making six round trips. If the number of bits could be reduced to four, a saving of eight hours would result. Bit companies are working on bit lubricating subs and sealed bearings which could readily accomplish this feat.

If these three practices are successful, it could conceivably be possible to spud in, set surface casing, and drill to 10,000 feet all in total time of a little more than 3½ days.

ACKNOWLEDGMENT

The author wishes to thank the management of Gulf Oil Corporation for permission to publish this article.

About The Author

Virgil C. Stone was graduated from the University of Oklahoma in 1949 with a degree in Petroleum engineering. In 1945, he worked with The Ohio Oil Company as a roustabout. Following graduation from college he joined Gulf Oil Corporation as a petroleum engineer in the training program. With Gulf Oil Corporation he has held the following positions: Petroleum engineer, assistant area petroleum engineer, area petroleum engineer, district drilling engineer and his present position of area drilling foreman.

Drilling practices used during the record drilling performance

			HYDRAULICS						
Depth	Weight	RPM	Liner	SPM	GPM	Pressure	Jet Size	Jet Vel ft. sec.	Ann Vel ft. mi.
673	15	300	7 x 18	60	600	1600			
			6½ x 18	50	430				
2,542	20—15	300	7 x 18	60	600	1600	9/16	355	90
			6½ x 18	26	220				
4,300	60—80	300	7 x 18	60	600	2000	7/16	420	205
7,510	70—80	200	7 x 18	56	560	2000	7/16	390	190
9,120	80	150	7 x 18	60	600	2100	½	325	205
10,000	60—80	200	7 x 18	56	555	2200	½	300	190

Better prices essential to improvement of earnings

By L. J. Logan
Associate Editor, WORLD OIL

THE FIRST QUARTER of 1960 is bringing a continuance of the unfavorable trend of earnings that the oil industry encountered in the fourth quarter of 1959.

Prices of petroleum products and crude oil are around their lowest levels of the industry's 1957-1960 recession. The low prices tend to cancel the benefits of the continuing increases in volumes of business, as petroleum demand sets new records.

Oil industry earnings were at their lowest levels of recent years in the first and second quarters of 1958. They improved in the third and fourth quarters of 1958. In the first and second quarters of 1959 they showed further sharp recoveries of about 20 and 30 percent, respectively, over one year previously.

But after mid-1959 oil earnings ceased to improve. In the third quarter of 1959 they were up only about 1 percent. In the fourth quarter of 1959 they were down about 11 percent from the final quarter of 1958 (see Table).

Thus, the latter half of 1959 was a disappointment for the oil industry, and the fourth quarter was especially disappointing. For the first half of 1959, earnings were up 26 percent over 1958. For the first nine months, the increase shrank to 16 percent. For the year as a whole, the improvement further dwindled to a gain of only 7 percent over depressed 1958.

The unfavorable oil earnings trend of the latter half of 1959 was caused only in part by the long steel strike, which reduced demand for industrial fuel oil and lubricants and probably lowered demand for gasoline. A major adverse factor was continuing weak markets for petroleum products, due to over-supplies. Also, December 1959 was warmer than normal, in contrast with the unusually cold December 1958. Sales of heating oils consequently lagged badly, and prices were depressed.

January and February 1960 brought continuance of warmer than normal weather in the principal oil-heating regions and persistence of depressed prices of heating oils. Gasoline meanwhile was in seasonally low demand, and its prices likewise were weak.

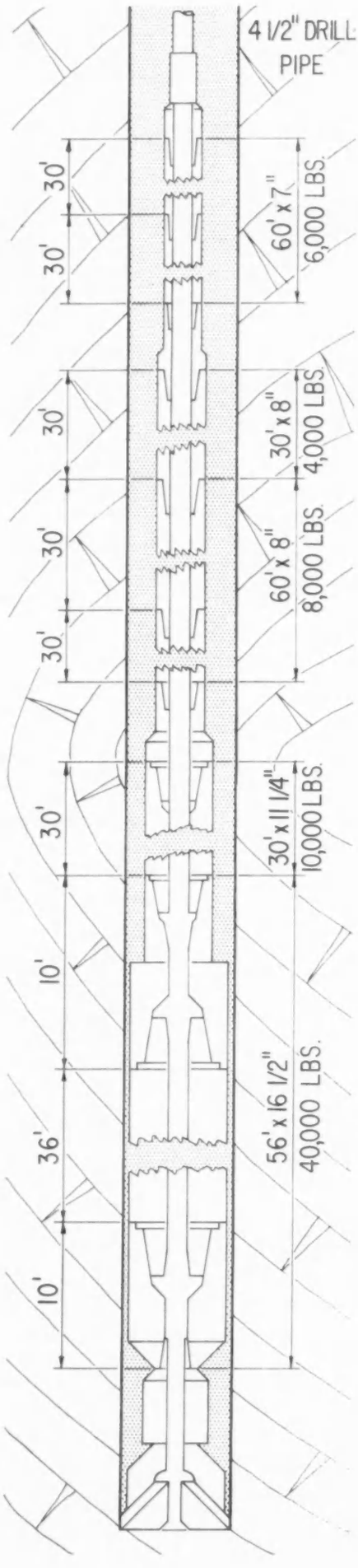
The continued unfavorable trends indicate that industry earnings of 1960 will fail to equal those of 1959, at least in the first quarter and probably also in the second quarter. In the third and fourth quarters of 1960 it will be less difficult to match year-earlier results, which were disappointing. Nevertheless, because of a poor start, the industry may be unable to earn as much in the whole year 1960 as it did in 1959. —**The End**

Net Earnings of Some Oil Companies in 4th Quarter and Year, 1959 vs. 1958

(All "per share" data are based on the number of shares of common stock outstanding Dec. 31, 1959)

	4TH QUARTER					YEAR				
	$ Thousand		$ Per Share		%	$ Thousand		$ Per Share		%
COMPANY	1959	1958	1959	1958	Dif.	1959	1958	1959	1958	Dif.
Anderson-Prich	2,018	1,089	1.15	0.60	+ 85	6,885	3,846	3.90	2.08	+79
Ashland O. & R.	3,627	3,232	0.53	0.46	+ 12	14,744	9,989	2.13	1.35	+48
Atlantic Ref. Co.	6,199	16,950	0.65	1.84	— 63	30,174	36,130	3.19	3.86	—16
Continental Oil	14,970	14,537	0.71	0.69	+ 3	60,300	48,400	2.85	2.29	+25
Gen. Amer., Tex.	1,088	2,291	0.33	0.68	— 52	4,927	6,397	1.47	1.91	—23
Gulf Oil Corp.	73,525	125,140	0.73	1.25	— 41	290,000	329,533	2.90	3.29	—12
*Imperial Oil	16,720	16,173	0.52	0.51	+ 3	54,400	50,620	1.72	1.61	+ 7
*International Pet.	7,800	3,900	0.54	0.27	+100	23,600	17,000	1.62	1.17	+39
Leonard Refineries	274	281	0.25	0.26	— 2	1,340	1,488	1.20	1.33	—10
Maracaibo Oil	51	119	0.10	0.24	— 57	244	337	0.50	0.69	—28
Ohio Oil Co.	11,310	9,128	0.81	0.65	+ 24	38,633	32,156	2.76	2.30	+20
Phillips Pet. Co.	26,614	26,591	0.77	0.77	.....	104,000	84,200	3.03	2.45	+24
Plymouth Oil Co.	d610	1,712	.....	0.64	.....	2,186	4,588	0.84	1.79	—52
Quaker State Oil	564	550	0.68	0.67	+ 3	2,328	1,890	2.82	2.29	+23
Shell Oil Co.	43,345	39,551	0.72	0.65	+ 10	147,400	128,583	2.43	2.12	+15
Sinclair Oil Corp.	10,475	14,132	0.68	0.92	— 26	45,500	49,473	3.00	3.23	— 8
Socony Mobil	39,600	47,386	0.82	0.98	— 16	162,600	156,786	3.35	3.23	+ 4
Standard, Calif.	73,885	70,015	1.17	1.11	+ 6	254,000	257,759	4.01	4.08	— 1
Standard, Ind.	33,411	31,326	0.93	0.88	+ 7	139,600	117,775	3.90	3.29	+19
Standard, Ky.	3,543	3,611	1.36	1.39	— 2	14,726	14,053	5.65	5.40	+ 5
Standard, N.J.	149,000	167,500	0.69	0.78	— 11	626,000	562,500	2.91	2.72	+11
Standard, Ohio	7,102	6,570	1.43	1.32	+ 8	25,061	24,044	5.02	4.82	+ 4
Sun Oil Co.	10,693	9,439	0.87	0.77	+ 13	42,844	32,061	3.48	2.60	+34
Texaco Inc.	92,146	82,838	1.52	1.37	+ 11	354,000	311,155	5.85	5.14	+14
Texas Gulf Prod.	1,301	1,446	0.33	0.35	— 10	4,180	3,970	1.04	0.98	+ 5
Texas Pac. C. & O.	2,014	2,065	0.52	0.59	— 2	7,197	6,231	1.85	1.67	+16
Wilcox Oil Co.	315	324	1.00	1.04	— 3	983	910	3.14	2.91	+ 8
*Total 25 Companies	606,460	677,823	.....	.....	— 11	2,379,852	2,224,254	.....	.....	+ 7

* Imperial and International are excluded from totals, being included as affiliates of Standard (N.J.)
d Deficit.



King-size drill collars cut surface hole drilling costs

This drill collar, already used successfully in the Alberta Foothills, can save money in steep-dip formations

By Robert W. Craig
The National Supply Company
Torrance, Calif.

THE LARGEST DRILL COLLAR ever used, 16½ inches in diameter, 56-feet long and weighing 20 tons, is proving itself as a means of not only greatly increasing drilling rate, but by maintaining a straight hole in steeply dipping formations in the Alberta Foothills region, an area long noted for difficult and high cost surface hole drilling.

Reflecting a continuation of the trend toward larger and heavier drill collars, the new super-size collar was built for General Petroleum Drilling Company Ltd., Calgary, in an effort to overcome the costly and serious problems of drilling surface holes in the Foothills area. After evaluating the results obtained in previous instances where large collars were used, which up to now were the 11¼-inch size in 12¼-inch holes first instituted by Shell Oil Company at Jumping Pound, General Petroleums Drilling Company Ltd., believed that even greater increases in size and weight might yield proportionately improved results. Consequently, a 16½-inch drill collar was manufactured for use in the 17½-inch surface hole.

Tapered string. The drill collar string in the first hole, Home, Hudson's Bay Marble Mountain 12-9-34-9, located in the Foothills about 165-miles northwest of Calgary, actually was a tapered string with the 16½-inch collar on the bottom. The string consisted of the 17½-inch three cone rock bit and bit sub and, above it, the 56 feet of 16½-inch drill collars. Next above it was a 30-foot, 11¼-inch collar; next, 90 feet of 8-inch collars and, finally, at the top of the drill collar string, 60 feet of 7-inch collars. This made a total of 236 feet of drill collars, representing a total weight of 68,000 pounds. Drill pipe used was 4½-inch.

By the time the large 16½-inch collar string had arrived at the site on July 10, 1959, some 368 feet of surface hole had been drilled, and which required 72 hours, using the smaller drill collar string. With the large collar in the string, the first bit made 100 feet in 14 hours; the second bit made 55 feet in 6 hours and the third bit made 70 feet in 7 hours. From a photograph taken of the third bit, it could be seen that the teeth were completely worn off, indicating that full efficiency and hole-cutting ability had been obtained in that short period of 7 hours on bottom. The fourth bit drilled 18 feet in 2½ hours and the fifth and final bit cut 9 feet of hole in 2½ hours. The deviation at total depth of 620-feet surface hole was seven-eighths of one degree. This is considerably less than was customarily experienced on earlier jobs in which smaller drill collars were used and where it often required as much as a month to drill to 1,000 feet.

On the initial large collar job, rotary table speed was held at around 120 rpm, with weight on the bit varying between 30,000 and 40,000 pounds. Mud circulation was approximately 550 gallons per minute. Power requirements for the rotary table ranged from 150 to as high as 250 horsepower.

Second hole also successful. In mid-August, the 16½-inch drill collar string drilled another surface hole in the Wildcat Hills area some 40 miles west of Calgary. The first 17½-inch bit made 372 feet and the sec-

FIGURE 1 (left)—The drill collar string used in the Marble Mountain surface hole actually was a tapered string, with the 56 feet of 16½-inch on bottom; a 30-foot, 11¼-inch collar above it; 90 feet of 8-inch collars next above and, at the top of the string, 60 feet of 7-inch collars. This made a string of drill collars 236 feet long and weighing 68,000 pounds. Drill pipe used was 4½-inch.

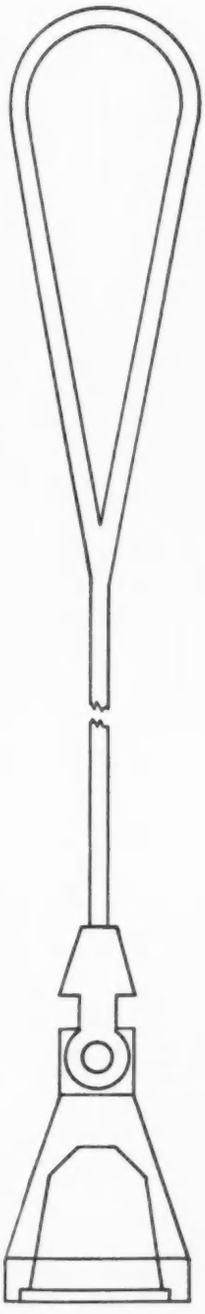


FIGURE 2 (above)—Sketch of lifting device used in handling the 16½-inch collars, comprising thread protector, clevis, socket and 1¾-inch wire line loop.

FIGURE 3—Set of 16½-inch drill collars, weighing 40,000 pounds, is readied for shipment from plant in Torrance, Calif., to well in Alberta Foothills region. Note special lifting socket to which is attached clevis and 1¾-inch wire line loop for handling on the well.

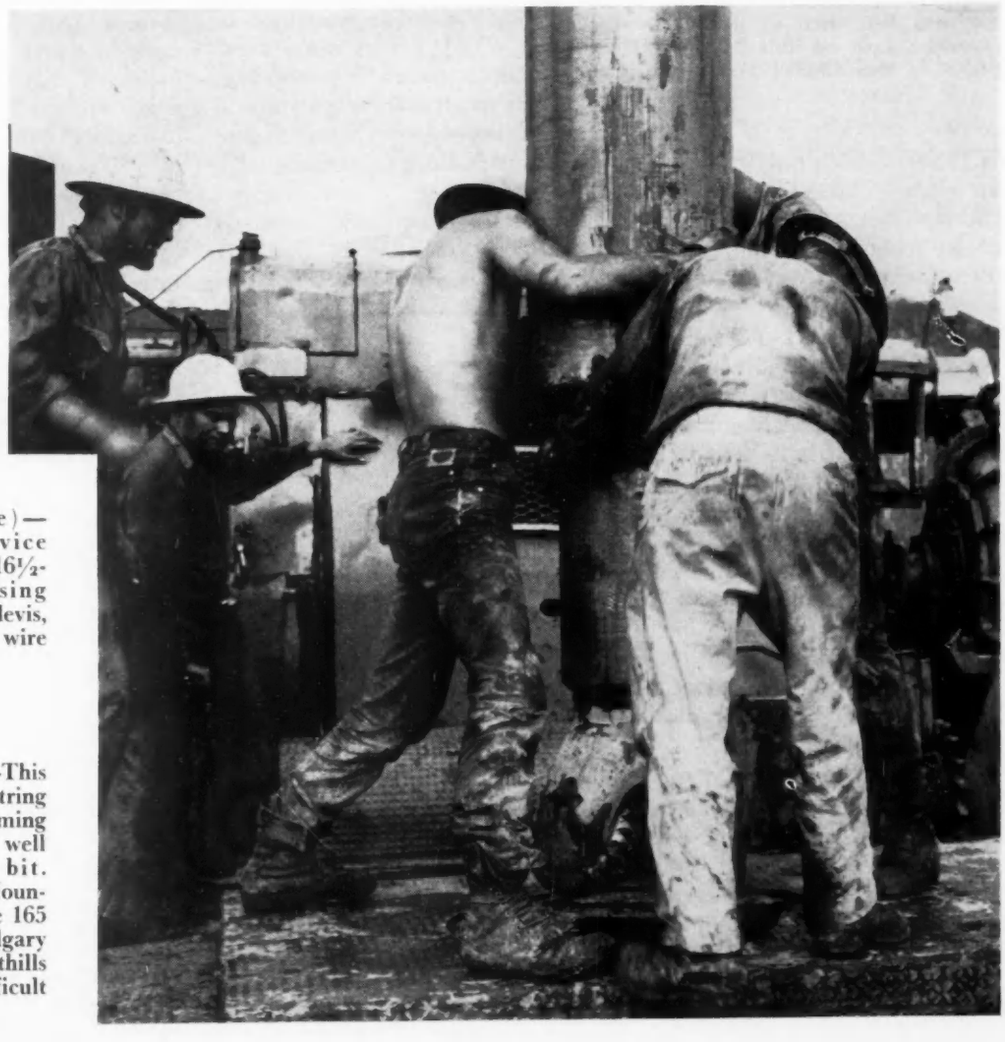


FIGURE 4 (right)—This 16½-inch by 56-foot string of drill collars is coming out of the hole with a well worn 17½-inch rock bit. Well is in Marble Mountain area, located some 165 miles northwest of Calgary in the Alberta Foothills region noted for difficult surface hole drilling.

FIGURE 5—Dwarfing drilling personnel on derrick floor, the 16½-inch, 56-foot drill collar, weighing 20 tons, is picked up preparatory to being re-run in the hole. Collar was first used in drilling 17½-inch surface hole on this Marble Mountain well in the Alberta Foothills area.

ond made 133 feet; both having been run in an elapsed time of only 23 hours. The 900 feet of surface hole was made in record time and, like the initial test, the hole was straight and in excellent condition.

The Western Canada Foothills practice of "filling the hole" with large drill collars, was started in about 1952, when 11¼-inch collars were run in 12¼-inch hole, leaving only one-inch clearance. At that time there was skepticism as to the use of such large collars; however, this feeling soon was dissipated when faster and straighter holes resulted. Also, the cost of such collars could easily be amortized in faster and generally improved drilling conditions. Since then, between 50 and 60 large collars, ranging from 11¼-inch to 12½-inch (representing the majority of the large size collars ordered) have been sent to not only Canada, but to the Gulf Coast, India, Venezuela and elsewhere. In 1954, two slightly larger collars were made up on special order: one was a 12-inch by 50-foot collar that went to India; the other was a 12½-inch by 15-foot collar that was used in California.

Prior to the advent of the 16½-inch collar, surface hole drilling of the tough, steeply-dipping and fractured limestone and chert beds of Cretaceous age in the Alberta Foothills required much skill, patience and time, to say nothing of many rock bits. The practice had been to hold up, with very little weight on the bit and rotate at fairly high speeds, in the order of 300 rpm's or higher. While this kept the hole fairly straight, drilling was very slow. Whereas the 13⅜-inch surface casing hole in the prairies area might require only a few days, the same hole in the Foothills area might require 10 times as long to complete, and as many as forty 12¼-inch bits to a depth of 900 feet.

Rigidity important factor. The contractor felt that 16½-inch collars used in a 17½-inch hole should give comparable results as experienced with 11¼-inch collars used in 12¼-inch holes. Also, with the added rigidity, stiffness increasing in proportion to the fourth power of the diameter, such a collar would be in the order of 4½-times more rigid than a 12-inch collar. The rigidity, plus the much greater weight, would permit putting more weight on the bit and thus make a faster hole with less risk of deviation.

The first collar actually was made in three pieces, one 36-feet long and two 10-foot pieces, making a total of 56 feet. The 36-foot section was of the double pin type; the two 10-foot sections, or subs, were of the box type.

A special chrome-nickel-moly alloy was designed with sufficient "hardenability" to accept heat treatment through the extraordinary thickness (almost 18 inches for the forged steel blanks). Special forging and lathe operations, employing equipment designed for marine shafting and Navy gun tubes, including trepanning for the 3½-inch internal bore, were used in manufacturing the large collars.

Designing the tool joint threads and making a set of tool joint gauges for the super-size collars presented other problems. For this large a collar, it was decided to use a H-90 tool joint since that thread, cut with a wider, 90-degree angle, could be broken out more easily than could conventional large size API and similar tool joint threads.

Special tongs needed. Make-up torque recommended for the 16½-inch collars with H-90 tool joints was between 40,000- and 50,000-foot pounds. Experience on the first two wells in which the collars were used indicated that this figure was about right. It was determined that for breaking out the large collars a torque of between 80,000- and 100,000-foot pounds was necessary. This amount of torque is considerably beyond the capacity of conventional rotary tongs, and tong manufacturers have designed special drill collar tongs with a 5-foot lever arm which are rated at 150,000-foot pounds.

Lifting equipment (Figure 2) consisted of lifting-type thread protectors for both boxes and pins. Each lifter was equipped with an eye through which a 1¾-inch wire rope sling equipped with clevis and pin could be slipped, then be picked up with the hook.

This first string of 16½-inch collars, already used on two holes, now is being considered in plans for a deep Alberta Foothills test to be started in the near future by the same drilling contractor. Although results of the first two tests of the king-size collars are not sufficient to represent a full evaluation, the contractor has indicated that results definitely appear to be promising. More complete evaluation will come after a number of wells have been drilled with the large collars. —**The End.**

About the Author

R. W. (Bob) Craig, after graduation in 1921 from the California Institute of Technology, joined Union Tool Company which, later, was acquired by The National Supply Company. He has been with National in engineering and sales capacities since that time. He has assisted in the rigging-up and operation of drilling rigs in many foreign fields, including the Middle East and Far East. He usually has rigged up, in various United States and Canadian fields, the first of new models or types of rigs introduced by National.

Producers continue to spend more than they receive

Tri-association survey reveals annual expenditures for producers increased 82 percent during 1948-1956 period, while annual income increased 45.1 percent

EXPENDITURES for exploration, development and producing oil and gas in the United States are mounting at a faster rate than production income. In fact, if income taxes, interest charges, dividend payments, and similar items were included, expenditures would be greater than total income.

Excluding the above items, following is a report on the trend in recent years:

- Capital outlays for exploration, development, production, and overhead in 1956 totaled $7 billion, or 95.7 percent of receipts totaling $7.3 billion. The percentage was 94.2 in 1955, and only 76.1 in 1948.
- Total expenditures increased 82 percent during the 1948-1956 period, while total receipts increased 45.1 percent.
- Expenditures for exploration and development, including applicable overhead, have exceeded 67 percent of total receipts since 1953.

U.S. Production Costs Are Increasing Faster Than Income

	PREVIOUS SURVEY (Millions of Dollars)			CURRENT SURVEY (Millions of Dollars)	
What Producers Spend[1]	**1944**	**1948**	**1953**	**1955**	**1956**
Exploration:					
Dry Holes	274	462	797	774	909
Lease Acquisition				651	561
Geological & Geophysical	327	570	987	306	360
Other				263	287
Total	601	1,032	1,784	1,994	2,117
Development:					
Producing Wells	593	1,058	1,762	1,826	1,959
Equipment	203	362	483	426	477
Total	796	1,420	2,245	2,252	2,436
Production:					
Production Taxes				258	278
Ad Valorem Taxes				166	169
Other				1,183	1,331
Total	566	1,097	1,846	1,607	1,778
Overhead:					
Exploration	44	79	172	189	208
Development	55	98	174	197	212
Production	61	115	227	232	252
Total	160	292	573	618	672
Total Expenditures	2,123	3,841	6,448	6,471	7,003
Oil and Gas Production	1,909	4,805	6,132	6,671	7,095
Other Lease Revenue	9	13	20	23	24
Royalty Payments Received	93	226	319	178	201
What Producers Receive[2]	2,011	5,044	6,471	6,872	7,320

[1] Excludes Federal, State, and local income taxes, interest payments, and returns to investors.
[2] Net receipts from production were determined by deducting royalty payments of 15 percent from the gross value of all production as reported by U.S. Bureau of Mines.

Tri-association study. This supporting evidence of the ever-tightening squeeze on returns from capital investment is revealed in a new study of producer expenditures and income. The report, for the years 1955 and 1956, was prepared by the American Petroleum Institute, Mid-Continent Oil and Gas Association, and Independent Petroleum Association of America.

The report stresses the fact that expenditures for all items have been exceeding total income. Thus, there has been a need for producers to plow back more internal funds into exploration, development and producing operations, and to attract new funds from outside sources.

According to the study, capital outlays for exploration increased 105 percent during the 1948-1956 period, to $2.1 billion.

Development costs, accounting for the largest share of total expenditures, increased 71.6 percent, to $2.4 billion. Production costs increased 62.1 percent to $1.8 billion, while total overhead increased 130 percent, to $672 million.

Latest survey more complete. Production costs reported for 1955 and 1956 are not entirely comparable with the costs in preceding years because of a change in estimating techniques.

In the latest study, production expenditures were analyzed in relation to the value of oil and gas production, whereas in the studies for 1944, 1948 and 1953, these expenditures had to be estimated on the basis of crude oil production alone.

Thus, the decrease in estimated production expenditures from 1953 to 1955-1956, shown in the table, reflects primarily the lack of complete comparability between the two studies, and should not be interpreted to mean that a decline actually occurred.

The industry's receipts include only funds generated internally and exclude borrowed and equity funds obtained from other sources for oil and gas production.

Information for the report was obtained from a survey of producers, ranging in size from the largest units in the industry down to small operators with only a few thousand dollars of annual receipts. Those who participated in the survey accounted for about 44 percent of domestic production of oil and gas. —**The End**

New ideas in winterizing

This Alaskan rig features compact equipment layout, self aligning components, an improved fuel system and adjusting panels

By Gilbert M. Wilson
Western District Editor
WORLD OIL

A NEW DRILLING rig winterized for sub-zero temperatures and gale strength winds, and equipped with a number of features designed to speed rigging-up and improve drilling operations, is operating in a remote southeastern Alaska area.

The rig was assembled, tested and shipped to Alaska by Clyde Hall Drilling Company, Bakersfield, Calif. It will be drilling for Richfield Oil Corporation in the Katalla-Yakataga area of southeastern Alaska. The site can only be reached by beach landing from the sea or by air.

The rig is equipped with a 142-foot mast, 12-foot sub-structure and is powered by three 600-horsepower, V-12 diesel engines. Nominal depth capacity is 20,000 feet with 4½-inch drill pipe.

Clyde Hall Drilling Company's winterized rig, used in deep exploratory drilling for Richfield Oil Corporation in Yakataga area of southeastern Alaska. Fully equipped with numerous work saving features, this rig is capable of drilling to 20,000 feet with 4½-inch drill pipe.

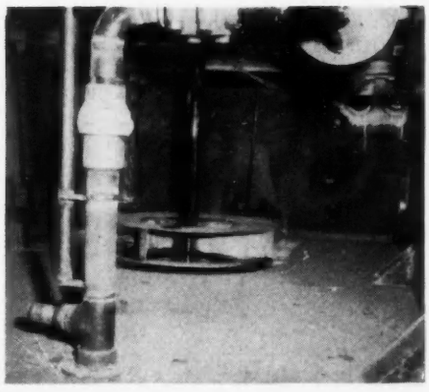
Compact layout. The entire rig, including mud tanks, shakers and manifolding is enclosed in a 50x100-foot area, winterized with easily-rigged paneling. A diesel fuel burning steam generator supplys heat to coil-blower units installed at strategic points around the rig.

The drawworks drum is grooved for a 1¼-inch line and is equipped with an automatic drilling control which can be set to automatically maintain the desired weight on the bit and to reduce drilling time whether in uniform formations or through rapidly changing lithology. The driller can regulate bit weight or switch to manual control at any time.

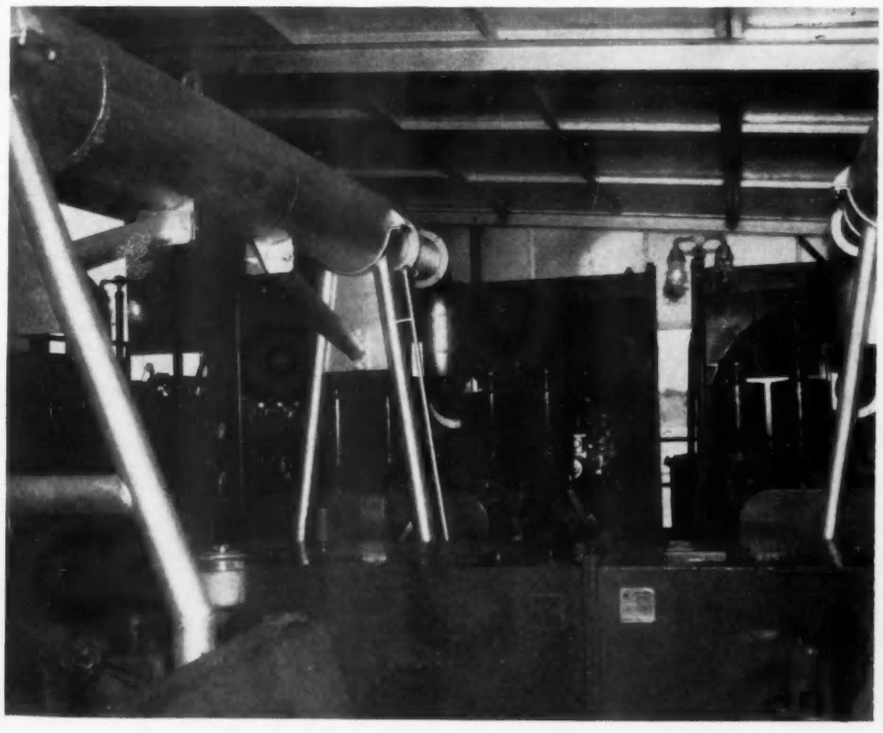
The 7¾-inch x 16-inch main pump is rated at 1,000 input horsepower at 65 rpm. The 7¾-inch x 18-inch secondary pump has an input rating of 600 horsepower at 60 rpm. Pumps are V-belt driven and placed side by side for compactness.

The rig is equipped with an auxiliary drawworks drive ("run-around") which provides a "soft" drive for the drawworks and rotary table, and other operating advantages. For example, two engines can be applied to the pumps for developing high mud pressures for jet drilling while, at the same time, the table can be powered with a moderate 150 horsepower

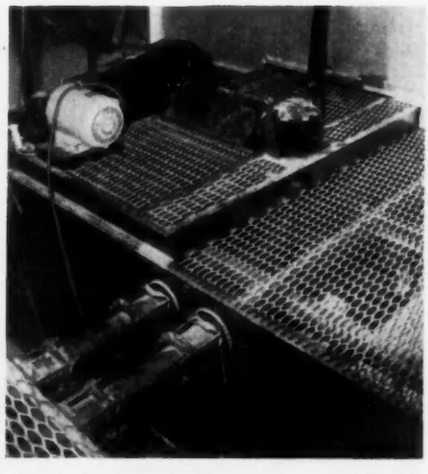
Winterizing panels were numbered and coded in such a way that sections can be quickly installed in proper positions. Note that each panel has its own lifting eye for easy, safe handling with a crane. Generator house is partly visible in left foreground while one of fuel tanks is shown in right foreground.



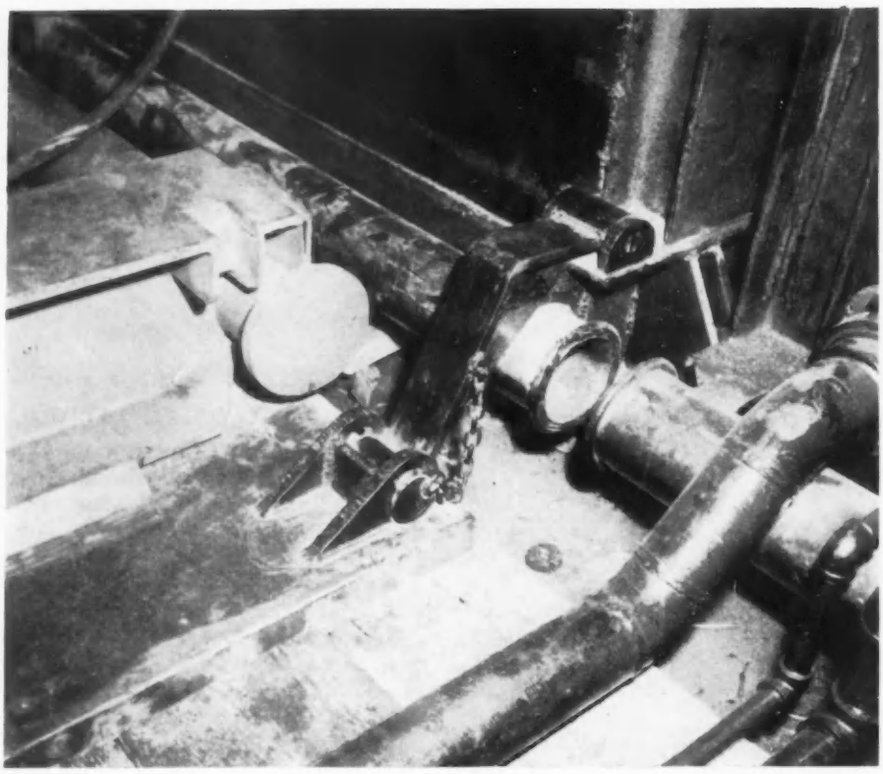
View from inside mud tank showing one of the mud agitators and, in foreground, one of the rotable mud guns. Agitator, suspended 6 inches off floor, turns at net speed of 100 rpm. Driven by 3-hp, 1,800-rpm motor mounted atop tank, speed reduction is obtained through V-belt drive and the automotive-type pinion-and-ring-gear right angle drive which turns the 3½-inch drill pipe vertical shaft. Agitator, which runs continually during drilling, is 3 feet in diameter, has four 6-inch wide vanes made from sections cut out of 20-inch conductor pipe. Mud fluid is drawn in at circular opening in upper disc, is forced out radially by impellers. Mud gun, foreground, is made of 3½-inch drill pipe and high pressure swivel joint for easy turning. The ¾-inch jet is a nozzle salvaged from a jet type bit. Vertical pipe welded to side of gun extends to top of tank where it is equipped with a valve handle for easy turning.



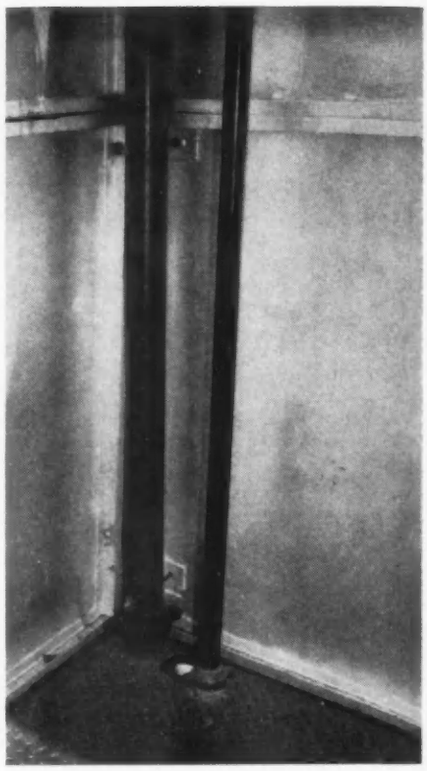
Breaking and cracking of flanges at the right point where the muffler connects with the engine exhaust manifold was largely avoided by two improvements built into the shop-made mufflers. Made of 13⅜-inch casing, the muffler rests on two legs. By installing sway braces at each end, most of the vibration or "rocking" of the unit is stopped. Other vibration is taken out or absorbed by a flexible section installed in the line between the engine and the muffler. Sway braces are attached by bolting, permitting them to be knocked down during moving operations.



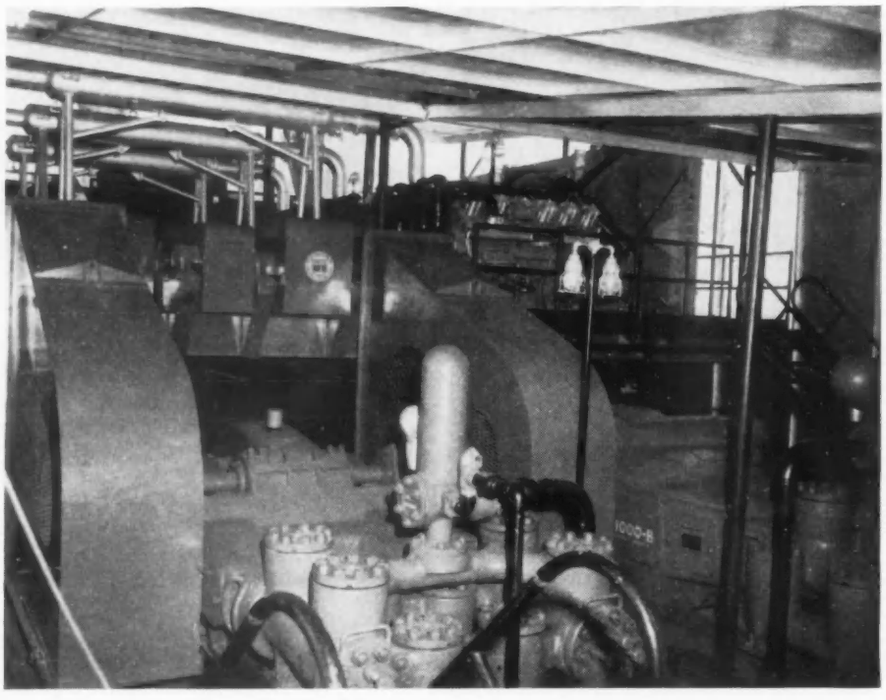
Typical installation atop mud tank of agitator driven by 3-hp motor with reduction through V-belts and pinion-and-ring-gear right angle drive at right. Mounted on gimbals, the gear unit is an automotive type easily replaced out of stock. Heavy expanded metal covers all mud tanks. Sectionalized, the covers are easily removed for work or inspection inside tanks.



Steel-clad mud pump mats are tied to rig substructure with heavy links of the type shown here. Bend in ¾-inch x 6-inch wide link is strengthened by gusset. Permanently hinged at rig end, link is attached to mat bracket by 1½-inch steel pin. Note that holes through which pin is run are elongated, permitting minor up-and-down flexibility to adjust for ground irregularities when rigging up.



Pipe posts to which winterizing panelling is bolted are equipped with hammer-type unions which speed erection and dismantling. Note that bolt hole in panelling are reinforced with welded steel pads to prevent tearing of the 12-gage metal.



All-enclosed rig area, the drive group, engines and pumps. The photo was taken from mud suction tank at rear of enclosure. Despite compactness, however, ample room was left between units for all normal servicing. All major components are linked together in an efficient, positive alignment system so that when the rig substructure is centered over the hole, all units fall in the proper place and belts automatically are in alignment.

transmitted through the run-around.

Should the pipe hang up, the run-around's 24-inch hydraulic coupling will stall out when more than 300 horsepower is applied to the rotary. Thus, excessive torque is eliminated and the possibility of twist-offs is reduced.

Rig units aligned automatically. A positive alignment system was designed for all major components of the rig. From the center of the hole, units are linked so that all lines, V-beltdrives, etc., fall in perfect alignment. This is accomplished through a system of links of steel pins and guides, including alignment guides for both mud pump bases (See accompanying photographs). The system provides:

- A substantial saving in rigging-up time.
- Easier rigging of all mud and utility lines without cutting or welding.
- All units are ready to go without further alignment of fittings.

The rotary table, modified by the contractor to provide additional sur-

face area, is locked to the substructure with 2-inch steel pins. When necessary, it is a simple matter to remove a portion of the flooring, knock out the pins and lift the table out. When re-installed, there is no question as to proper alignment. This method eliminates time normally required for tying down the table with turnbuckles.

Two centrifugal pumps maintain pressure in the 4½-inch water system between the 300-barrel tanks built into the sub-structure and the mud system, engines and wash-down lines.

Improved fuel system. The diesel fuel system is not operated under pressure. Fuel is pumped from the two side-by-side 10,000-gallon supply tanks to the small day tank near the engines through a 1¼-inch line. Overflow from the day tank automatically drains back through a 2-inch line to the main tanks.

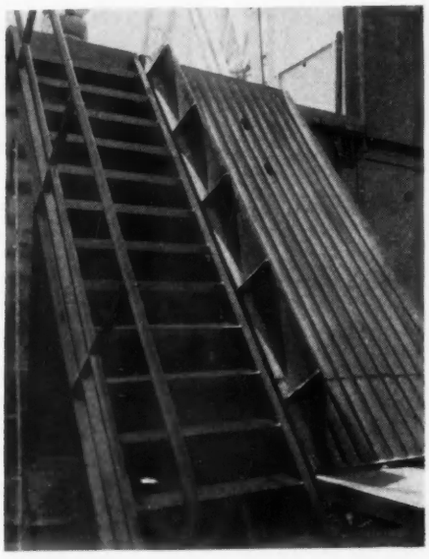
The pump, while keeping the day tank full at all times, does not maintain pressure on the system. The chief advantage of this system is the accurate regulation of fuel consumption during alternate periods of acceleration. With the present system, the fuel pump runs at a constant speed, the day tank is kept full and all excess fuel is returned to the supply tank.

The 600-barrel mud system is made up of three 8 x 40-foot by 4-foot high tanks. Air unions are used on all suction lines.

As a precaution against breakdowns, critical or key auxiliary equipment was installed in pairs.

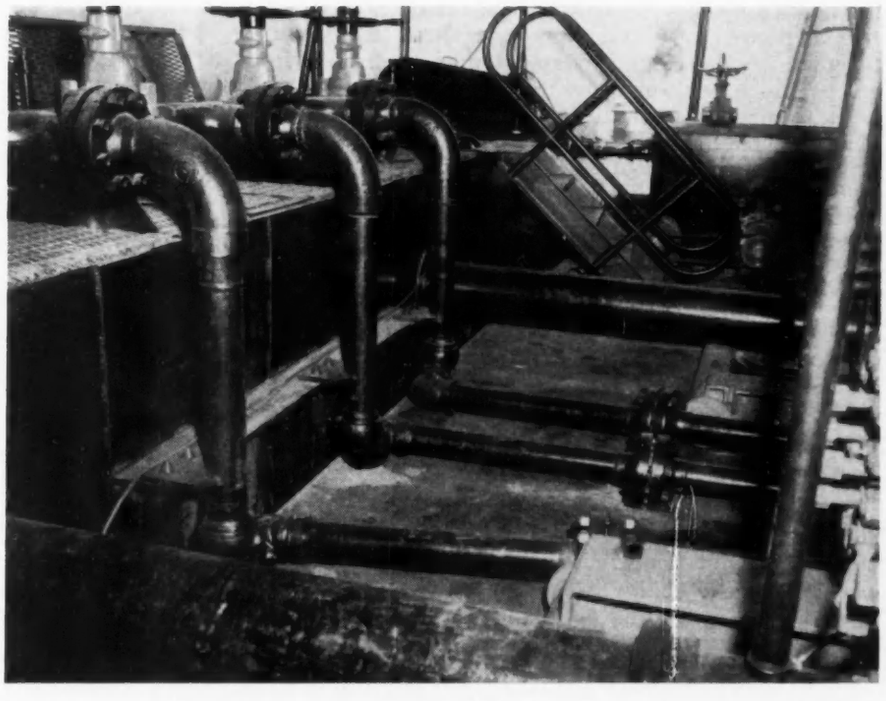
Winterizing consisted primarily of enclosing the entire rig area, including mud tanks and all manifolding, with unitized welded steel panels. Panels are of 12-gage steel, welded to channel sections and are strongly sway-braced at corners and other critical points. Panels were equipped with steel clips which permit installation in only one way, assuring precise fitting and matching of bolt holes. Panels are coded and numbered so that lost time can be avoided when they are pulled from a stack and installed on the rig. Corner posts on the rig floor were equipped with hammer type unions for easy, fast rigging-up and tearing out.

Adjustable engine panels. All doors in the enclosure are of the sliding type that are slung on over-

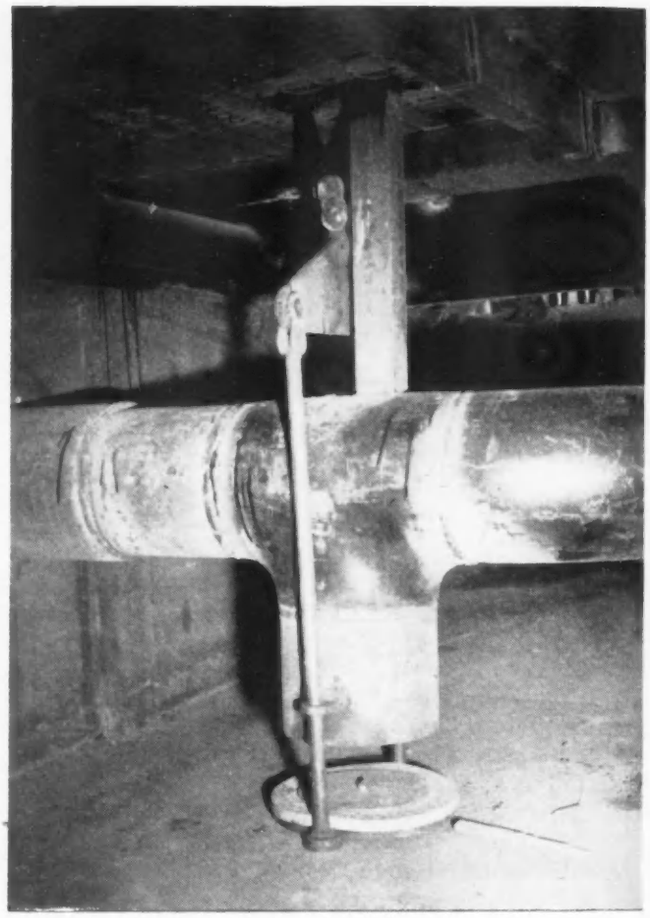


Ladder from pipe walk to derrick floor is doweled to prevent any possibility of shifting. Heavy steel plate batter board at edge of ramp prevents damage to ladder, or injury to personnel who might be on it, should a joint of pipe get loose. Holes in ramp, near upper end, are for attachment of slings when unit is rigged up. Hand rail uprights are set in pipe sockets to facilitate quick removal and installation during moves.

This type link ties steel-clad mud pump mats to mud suction tanks. Holes in mat bracket are elongated so as to allow sight vertical adjustment to compensate for ground irregularity, but horizontal movement is prevented. When rig is moved, bracket is released, swung up against tank and the 1½-inch pin run through the ears welded to it, thus preventing damage to link and assuring that it will be ready when units are tied together.



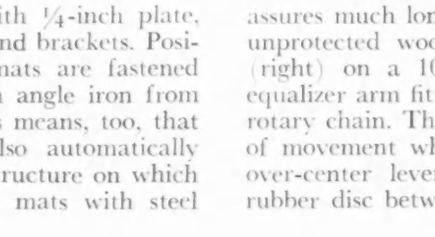
High pressure mud lines are manifolded atop mud suction tank. The 4½-inch lines, with swing joints at each end and equipped with long radius elbows, allow some misalignment and permit movement when the pump V-belts are tightened. Risers to manifold, however, are held in positive alignment by bracket which rests on ¾-inch steel plate shelf at side of tank. Tapered pin dowels fit holes in bracket; prevent any lateral movement. When moved, flanges at tank are unbolted and entire line is swung back on to pump where it remains until again rigged up.



Mud pump mats (left), sheathed with ¼-inch plate, are aligned by these close-fitting pins and brackets. Positive alignment of the pumps, once mats are fastened together, is assured by inverted 3-inch angle iron from guides which are welded to mats. This means, too, that when pumps are spotted, V-belts also automatically aligned, since mats are pinned to substructure on which drive groups are mounted. Sheathing mats with steel assures much longer like than the usual year or so when unprotected wood mats are used. A shop-made valve (right) on a 10¾-inch mud suction line employs an equalizer arm fitted with connectors made from salvaged rotary chain. The latter provides the necessary flexibility of movement when the valve is actuated by the snap-over-center lever atop tank. A single bolt holds the rubber disc between the two steel plates.

head rollers. In areas of high winds, hinged type doors are impractical. An unusual panelling feature was used in front of the engine radiators. Three 8-foot wide by 10-foot high panels were equipped to slide up and down between angle iron rails, dropping to the ground outside the bottom row of panelling. Each panel is raised by a small hand-operated winch of the type commonly mounted on truck beds for load binding. The panel for each engine, therefore, is easily adjusted to the position desired, depending on wind direction and outside temperature.

Rig heating is supplied by two diesel fuel burning steam generators (one a standby unit). It is estimated that these units will reduce fuel consumption by some ¾ of that required for conventional steam boilers used for this purpose. Steam is not vented to atmosphere, but is condensed and the water re-used. Not only does this reduce the need for make-up water, but by circulating treated soft water, scaling and related impure water problems are held to a minimum. Nine steam radiators, equipped with 1½-horsepower motors, are placed at strategic points around the rig. These include two for the rig floor; two for the BOP; two on the back mud tank, with blowers directed at manifolding; one on the water pump and the system in the utility alley beneath the engine radiators; one on the shaker tank; and another in the BOP accumulator house. The change room has a set of heating coils.



Recessed lifting eyes in all mats simplify rigging up operations. The lifting eye is a hinged piece of ⅝-inch steel plate fitted inside section of 6-inch channel iron. The channel iron is then bolted to second layer plank. Eyes are tilted up for attachment of sling or hook and are laid flat during normal drilling operations.

The rig will have to be serviced either by landing on the beach, or by air. Fuel will be supplied by tanker plane, a converted flying box car surplus craft equipped with tanks capable of holding about 10,000 gallons. All fabricated parts such as mud agitators, guns and other equipment, are interchangeable so that spare parts storage will be held within reasonable working limits. —**The End**

Australia is attracting oil operators

Incentives include huge exploration blocks, bonus payments, and reasonable royalty. Producers will have ready markets for their crude oil

By Anthony Gibbon, Mid-Continent District Editor, and **L. J. Logan,** Associate Editor, WORLD OIL

WHEN OIL is struck in Australia it will be on big acreage.

Leases in Australia have been granted in large, unbroken tracts. The smallest exploration permit is measured in several million acres. The larger ones are in the hundreds of millions of acres. Leases of this size are on the scale of whole states in the United States.

Multi-million acre exploration permits have been granted at no cost except an obligation to explore.

The government claims a reasonable royalty of 10 percent as compared with the customary 12½ percent in the United States and far higher percentages in such places as Venezuela and the Middle East.

Large cash bonuses are paid to support drilling. For example, the Delhi-Frome-Santos group received a subsidy of $716,000 toward the cost of its first well. It will receive $337,500 towards its second well. Other drilling companies will receive comparable help.

When a company finds oil there will be no well spacing problems. The fortunate company will have the entire oil field to itself, and any other fields found for miles around. It will be able to drain its reserves with a minimum number of wells and at maximum economic recovery rates.

Australia will probably never have daily allowables. The fields will probably be allowed to flow like the fields of the Middle East because Australia needs oil. With a population of 10 million, Australia uses about 216,000 barrels of crude oil a day, every barrel of which must be brought in by tanker, mainly from the Middle East. The annual bill is approximately $100 million. Domestic demand has risen 30 percent in the past five years.

Oil Production. The first commercial production was discovered in Australia in 1953 in the Desert Basin of Western Australia. The discovery well was Rough Range 1 of Australian Petroleum Pty., Ltd. (WAPET). (See map.) The well flowed 20 barrels an hour from around 4,000 feet. WAPET was owned 20 percent by Ampol (an Australian company) and 80 percent by Caltex. The well was shut in, and surrounding offsets have proved dry.

Temporary, non-commercial oil production was obtained more recently, in late 1958, in Papua, an Australian state on the island of New Guinea, several hundred miles north of continental Australia. That was in the Puri 1 well of Australasian Petroleum Company (Standard-Vacuum, British Petroleum Co., and Oil Search Ltd.) See map herewith and also WORLD OIL, August 15, 1959, pages 287-289.

Farther west in Dutch West New Guinea there are three commercial oil fields, known as the Klamono, Wasian, and Mogoi fields. (See map.)

Oil and Gas Shows. Following the discovery of oil in the Puri 1 well, in New Guinea, leasing and exploration increased materially in Australia. The leasing spread particularly over the Great Artesian Basin, one of the largest geological provinces in the world. (See the map of sedimentary basins etc., herewith.) Most of the area of that basin now is held under concession by major oil companies and independent operators.

Within the Great Artesian Basin, oil and gas showings have been found in shallow wells in numerous areas, although the whole continent of Australia, nearly as large as the United States, has had fewer than 50 deep tests drilled for oil. In the Great Artesian Basin there are many water wells, supplying water for cattle and sheep.

The Great Artesian Basin covers twice the area of Texas and resembles that state of 50 years ago. Deep sediments, plentiful shaley and limey sections, and many thick reservoir sands make up the basin. Possibilities of oil production have been indicated by the reported shows of oil and gas.

Lease Holdings. Leases have been granted by the Commonwealth government to more than a score of oil companies representing American, Australian, and British interests.

A breakdown of the leases is shown in a tabulation herewith. Locations of the different leases are shown on one of the maps herewith. Leases are numbered the same in the tabulation and on the map.

LEASES IN AUSTRALIA

(1) Delhi-Taylor Oil Corp., Dallas, 50 percent, and Santos Ltd., Australia, 50 percent, 137,000 square miles.

(1-A) Delhi-Taylor, Santos and Frome Broken Hill Pty. Ltd., each owning 33⅓ percent, 62,080,000 acres in southwestern Queensland and northeastern South Australia. Frome

Sedimentary Basins and Oil and Gas Occurrences in Australia and New Guinea

Broken Hill is owned by Standard Oil Co. (N.J.), Socony Mobil Oil Co. and American Metal Climax, Inc., from the U.S.; British Petroleum Ltd. and Consolidated Zinc Corp., both of Great Britain, and Interstate Oil, Ltd., Australia.

A deep test, Innaminka 1, was drilled in 1959 on a 2,000 foot closure, 15 by 50-mile anticline in the Great Artesian Basin in northeastern South Australia (See Map). It stopped drilling in mid-November 1959, after logging steeply dipping, thick red beds, probably Devonian, from 7,140 to 12,580 feet. The well had slight shows of oil and gas in the Mesozoic section.

The same rig was due to start drilling about Dec. 15, 1959, at the site of Betoota 1, Betoota anticline, southwestern Queensland, which had been defined by surface and seismic work. (See Map.)

(2) Plymouth Oil Co., U.S. 114,375 square miles. Geological work was under way in 1959.

(3) Stekoll Petroleum Co., U.S., 82,000 square miles.

(4) Magellan Petroleum Corp.,

U.S., 40,000 square miles in south central Queensland. Magnetometer and gravity meter surveys were under way in August, 1959.

(5) Australian American Oil Co. Pty. Ltd., Tulsa, wholly-owned subsidiary of Sterling Oil of Oklahoma, Inc., Tulsa, 18,900 square miles in Southern Queensland, near Longreach. A test well to 10,000 feet by 1961 is scheduled.

(6) L. H. Smart Oil Pty. Ltd., Australia, 15,800 square miles.

(7) Phillips Petroleum Co., Bartlesville, and Sunray Mid-Continent Oil Co., Tulsa, each 50 percent, 35,000 square miles in southwestern Queensland. This lease is in the Great Artesian Basin. A test will be drilled in 1960.

(8) Australian Oil and Gas Corp., Ltd., Sydney, Australia, Union Oil Co. of California, and Kern County Land Co., 60,000 square miles in southwestern Queensland and northern New South Wales. A deep test well will be drilled in 1960, following geological and geophysical work.

(9) Carpenteria Oils Pty. Ltd., Australia, 37,700 square miles.

(10) Papuan Apinaipi Petroleum Co. Ltd., Australia, 43,000 square miles.

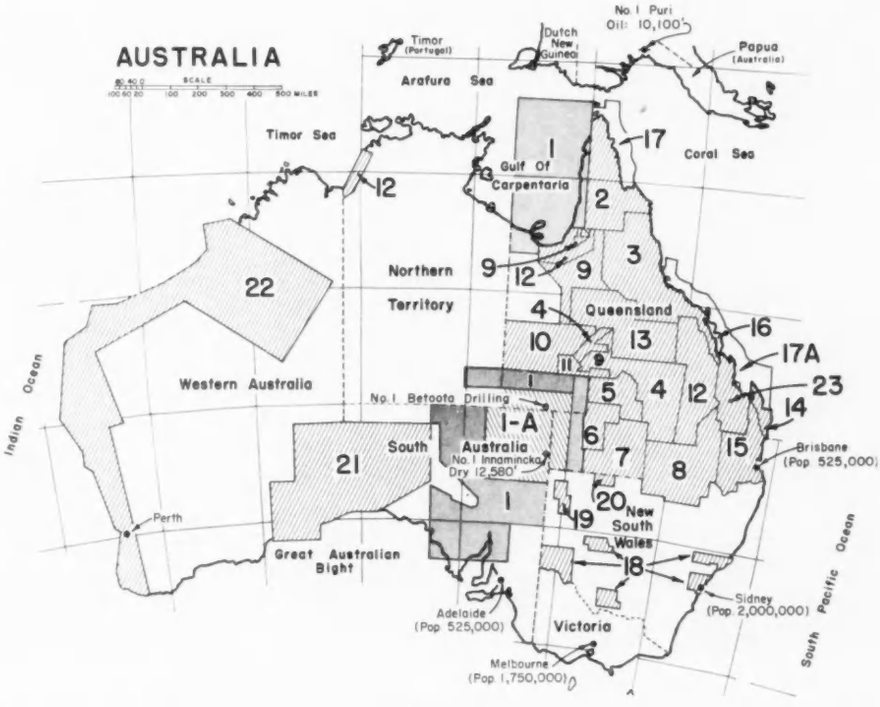
(11) Conorada Petroleum Corp., owned by Continental Oil Co., The Ohio Oil Co. and Amerada Petroleum Corp., U.S., 18,300 square miles in the heart of Queensland.

(12) Associated Australian Oilfields Ltd. and Associated Freney Oilfields Ltd., both of Australia, 33,400 square miles.

(13) Artesian Basin Oil Co. Pty. Ltd., jointly owned by Lucky Strike Drilling Co., Tulsa, and Joseph Bjelke Peterson, Australia, 57,900 square miles.

(14) Pacific American Oil Co., wholly-owned subsidiary of Lucky Strike Drilling Co., Tulsa, 10,000 square miles.

(15) Queensland American Oil Co., 50 percent, Sunray and Phillips each 25 percent, 29,500 square miles in Eastern Queensland. Queensland



Oil and gas leases granted by Australian government to more than a score of oil companies, including American, Australian and British interests. Numbers on map correspond with leases as numbered in the accompanying list of lease holders.

American is a wholly-owned subsidiary of Lucky Strike Drilling Co., Tulsa, Okla. A 6,500 foot test well has been planned for the Moreton Anticline, Ipswich basin, 30 miles south of Brisbane.

(16) Kan-Tex Oil and Gas Inc., an Arkansas firm, 12,000 square miles. This concession was formerly held by Reef Oil Co. Pty. Ltd., which is owned by Lucky Strike Drilling Co., Tulsa, Joseph Bjelke Peterson and Associates, Australia. Reef Oil retains an overriding royalty.

(17) Humber Barrier Reef Oils, Area 2, 56,500 square miles.

(17-A) Humber Barrier Reef Oils, Area 1, 18,800 square miles.

(18) Australian Oil and Gas Corp. Ltd.

(19) Texas American Oil Corp., Midland, Tex., 4,866 square miles in northwestern New South Wales.

(20) Lee Evans Australian Petroleum Ltd., subsidiary of Lee Evans Oil and Gas Co., Tulsa, 3.2 million acres.

(21) Oil Drilling and Exploration Ltd., Australia, 197,000 square miles in Western Australia. The Company's explorations subsidiary, Exoil Pty. Ltd., on November 26, 1959, started drilling a 3,000 foot stratigraphic well in the Eucla basin, near Madura, Western Australia, using a rotary rig.

(22) West Australian Petroleum Pty. Ltd., 186,848,000 acres. This company is owned 20 percent by Ampol Petroleum Ltd., Australia, and 80 percent by Caltex Oil Pty. Ltd., which in turn is jointly owned by Standard Oil Co. of California and Texaco Inc.

(23) Nortex Australian Oils, Ltd., wholly-owned subsidiary of Nortex Oil & Gas Corp., Dallas, Texas, 19,400 square miles (100 by 194 miles) in southeastern Queensland, along sea coast and running south to Maryborough, which is north of Brisbane. Nortex planned to start geological and exploratory operations January 1, 1960.

Note: The Nortex concession (23) at mid-December 1959 represented the last of the unleased acreage in Queensland except for a block in the extreme northwest corner of the state. (See map). —**The End**

FIGURE 1—Two hydraulc pumps which powered by a single 5-hp unit located midway between wells. Fluid exhausted on the downstroke from the hydraulic pump cylinder of one well assists in raising the rod string and fluid load of second well. Since the wells are approximately balanced, the power unit provides only that hp required to lift the fluid load of second well and power requirements thus are reduced.

New power package cuts hydraulic pumping costs

A NEW POWER PACKAGE has been used successfully on hydraulically pumped wells in California's Wilmington field. The unit utilizes the energy from the falling rods (downstroke) of one well to assist in lifting the rod string and fluid load of another well. Other features of the installation are:

- Capital investment is reduced. A single power source serves two wells
- Power requirements and costs are reduced
- Existing hydraulic pumping units can be converted for use with the new system if surface locations are not too far apart.
- Less maintenance is required
- Less heat is eliminated
- Operation is relatively quiet, a definite advantage in residential areas.

Cooper and Brain, Wilmington independent operators, have equipped two adjacent wells with the new unit (Figure 1). These wells now are pumped simultaneously with a single 5-hp electric motor. Prior to converting to the new system, each installation required a 10-hp motor for power, or a total of 20 hp for both wells.

Although final power cost savings have not been determined (the unit has been in operation only a short time), tests indicate that power requirements will be reduced by approximately 50 percent. Where the former power bill for the two individually pumped units ranged from $140 to $150 per month per well, the power cost for the single power package should be near $70 to $75 per month per well. Based primarily on power savings, the conversion shows a payout of slightly over one year.

Wells converted so far are equipped with originally installed 6-foot stroke hydraulic units, and are pumping from a depth of about 3,100 feet. Bottom-hole equipment is conventional; both wells are equipped with 2¼-inch plunger tubing-type pumps, operating at 2½ strokes per minute.

Gross production from each well is approximately 24 bpd of 15 gravity crude. Water cut is approximately 4 percent. Production is from the Ranger-Terminal zones at a vertical depth of about 3,600 feet. One of the wells is vertical; the other is slant drilled. As shown in Figure 1, the wells are about 20 feet apart.

Power system. Operation of the power system is based on the principle that energy from the downstroke of one well can be used to assist in raising the rod string and fluid load of a second well. The system used at Wilmington consists of a closed hydraulic circuit, two hydraulic pumps, a 4-way reversing valve, a pilot valve, prime mover (5 hp electric motor), fluid reservoir and assorted valving, piping, etc.

The main hydraulic pump in the system is connected through a 4-way reversing valve to the well pump power cylinders of both wells. The pump inlet receives fluid under pressure from the pumping unit power cylinder of the well on the downstroke cycle. The system pump boosts this inlet pressure to that pressure required to lift the rod string and fluid load of the second well. Since the pumping unit power cylinder of the second well is connected to the system pump through the 4-way valve, it is actuated and the upstroke cycle is obtained with only "make-up" power required from the prime mover.

As the upstroke cycle is completed, a hydraulic signal is transmitted to the 4-way reversing valve through a pilot valve. This signal automatically switches the action of the 4-way valve and allows the operation to reverse.

Example. Figures 2 and 3 are schematic drawings of the system used at Wilmington. Referring to these figures, actual operation of the unit is as follows.

Pump 2 is used to start the unit, with pump 1 unloaded and circulat-

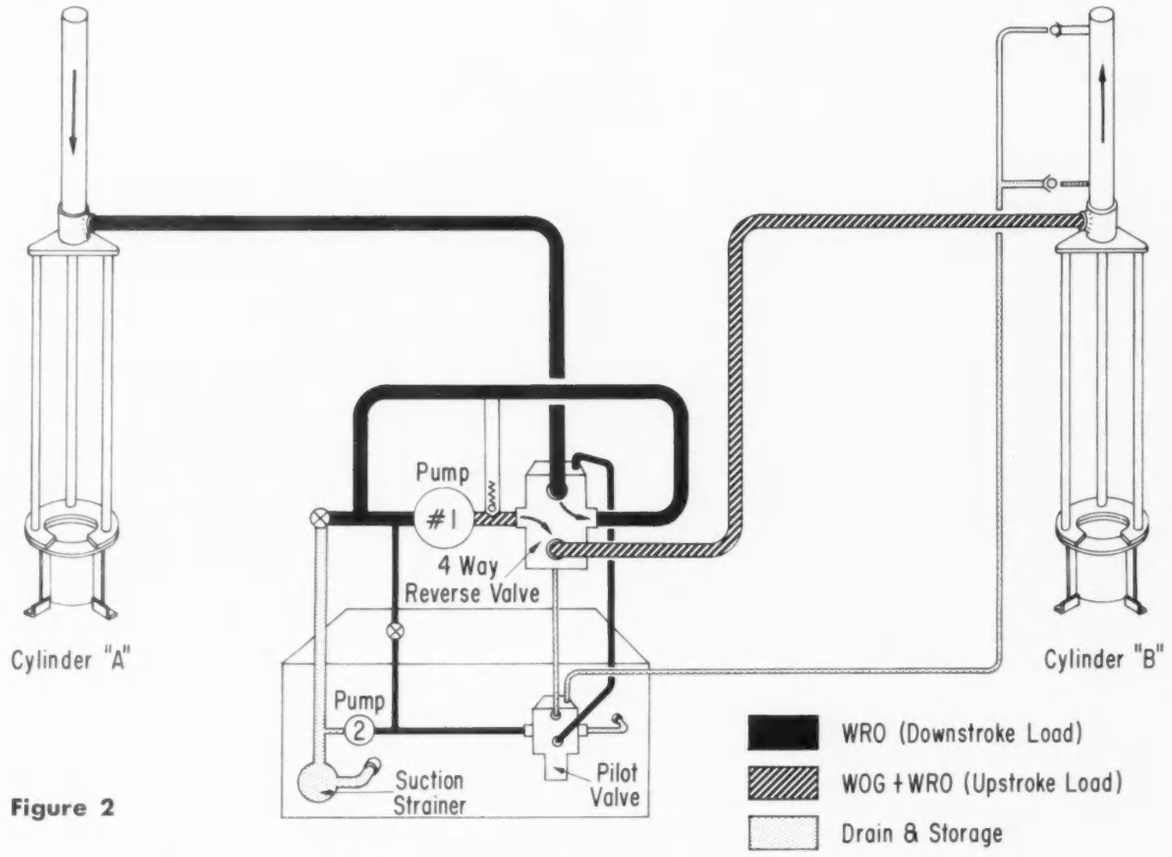


Figure 2

These schematic drawings show one complete cycle of the power unit used at Wilmington. In Figure 2, hydraulic pump cylinder A is beginning a downstroke and pump cylinder B is beginning an upstroke. Fluid symbols indicate hydraulic fluid flow conditions at the instant of reversal. In Figure 3, the units have reversed with cylinder A beginning an upstroke and cylinder B beginning a downstroke. Note that in both cases the power unit hydraulic pump intake manifold (pump 1) is continuously pressurized with the downstroke load.

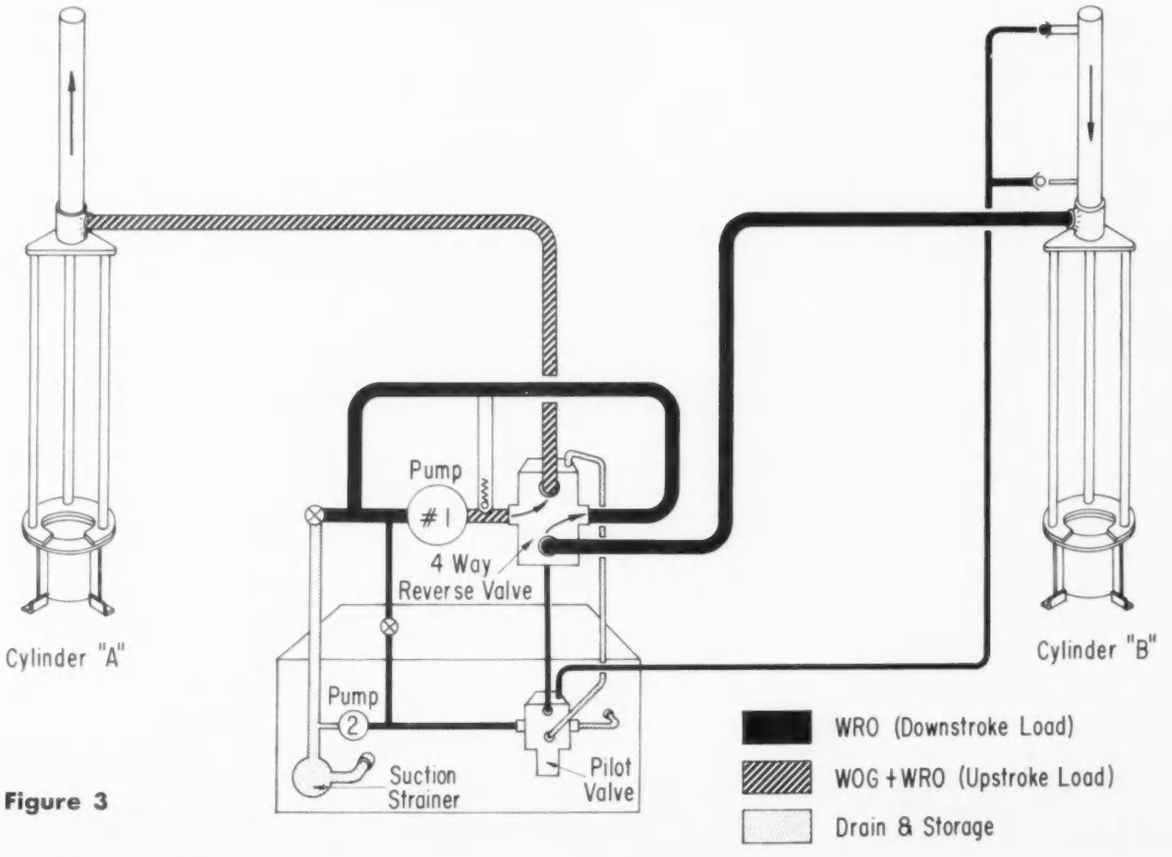


Figure 3

ing fluid. The discharge from pump 2 is aligned to cylinder B through a manually operated valve. Cylinder B is raised approximately 4 to 6 inches to assure complete hydraulic fill in the lines. A second manual valve resets the 4-way valve to connect pump 2 to cylinder A. The piston in cylinder A is raised to the topmost position and is ready to begin a downstroke cycle. Pump 2 then is re-aligned to the inlet of pump 1 by the manually operated valve.

The 4-way reverse valve is reset for automatic operation with the second manual valve. The cycle is begun by adjusting the relief valve controlling pump 1 to the desired pressure setting. Cylinder B thus is started on the upstroke cycle.

In Figure 2, the fluid below the piston in cylinder A is under pressure due to the weight of rods in fluid. Cylinder A is connected to the inlet side of pump 1, which receives this supercharge of fluid at the elevated pressure. Pump 1 then supplies the additional pressure or "boost" to well pump cylinder B required to complete an upstroke cycle.

When the piston in cylinder B reaches the upper reversal port, a hydraulic signal shifts the pilot valve spool against spring tension, thus relocating the 4-way reverse valve spool (Figure 3). The fluid in cylinder B then is directed through the reverse valve to the inlet of pump 1.

The pump again provides the additional "boost" required to raise cylinder A against its upstroke load. Cylinder B, being the control cylinder, is on a downstroke as cylinder A is on the upstroke. When the piston in cylinder B passes the lower reversal port, the fluid under pressure compressing the pilot valve spring is relieved to atmosphere, allowing the spring to shift the spool and in turn relocate the reverse valve spool. A complete cycle now has been made and the procedure will reverse with cylinder B performing an upstroke as cylinder A commences the downstroke.

Pump 2, which is a small vane-type make-up pump, is belted to the same prime mover as pump 1. Pump 2 has a discharge capacity of 3-5 gallons per minute and is used to maintain a constant fluid volume in the closed hydraulic circuit. In addition, the pump provides fluid under pressure for valve actuation.

Heat normally given off when a unit (operating singly) discharges fluid to the reservoir on the downstroke cycle is eliminated in the new system, since all fluid is discharged through 1½-inch surface lines directly to the well pump cylinder of the second well. A counterbalancing valve located on the discharge side of pump 1 (in the power package) maintains constant pump speed, which evens the load and eliminates pump pulsations.

Horsepower requirements are calculated in the conventional manner, using well loads and their relationship to cylinder areas and pump output. The formula used is:

$$BHP = \frac{WOG \times GPM + 5\ WRO}{CYL.\ AREA \times 1715\ K}$$

Where:

BHP = Brake horsepower
WOG = Fluid load on the gross plunger area, in pounds
WRO = Weight of rods in oil, pounds
GPM = Pump output, gallons per minute
CYL Area = Cylinder area in square inches
K = Constant for over-all mechanical efficiency

Horsepower requirements of the single power package are reduced since the net load on the unit during the upstroke cycle is essentially only the weight of the fluid load on the plunger. Although the unit also supports the weight of the rod string in oil, this weight is balanced (or approximately so, though there is some small drag of rods in the slant-drilled well) by the weight of the rods in the adjacent well. The pump circuit therefore is required to furnish only the pressure necessary to raise the fluid load.

Other applications. Deeper wells using hydraulic pumping units also can be converted for use with the new power system. As an example, two deep wells located 300 feet apart have been successfully equipped with the dual power unit. Both wells are equipped with tapered rod strings (1⅞-¾-inch) and 1¼-inch bottom hole pumps. Pumps are located at 8,672 and 8,938 feet

The power unit is installed approximately 20 feet from one well and 280 feet from the other. The installation has operated satisfactorily since October 1959.

Originally, one well was produced by plunger lift and the other by a long-stroke hydraulic unit which was powered by a 15-hp motor which actually drew 12 hp. The present installation is equipped with a 30 hp motor which draws about 11-12 hp. The additional hp is required to power one well when the other is shut-in for a pulling job, etc.

The long stroke units now on the wells are identical and operate at 2.3 cycles per minute with a 9.2-foot stroke. One well produces approximately 15 bfpd with 50 percent BS&W and the other about 12 bfpd with 35 percent BS&W. Crude is 30 gravity.

The unit operates quietly which is a prime consideration in town lot production. Noise is barely audible at from 20-30 feet.

In any installation, the two-well circuit provides for the operation of one well at a time should one require pulling or servicing. Single unit operation is accomplished manually by opening one valve and closing another. Single unit operation, of course, requires a slower cycle rate or sufficient installed horsepower to operate unbalanced.

Within reasonable limits, pump depth, volume of fluid produced and pump bore of any two wells need not be identical for conversion to the dual pumping system. One limitation would be the upstroke load, since the total horsepower requirement must be determined by the load imposed by the heavier well. An example of this type of unbalanced condition has been considered.

One well pumping from about 5,000 feet produces 45 bpd gross fluid with a 1½-inch pump. Both wells are equipped with tapered rod strings consisting of ¾ and ⅝-inch rods.

On the basis of data available, it is estimated that about 7 hp would be required for a power package designed to pump both wells simultaneously.

Because of the variables involved, each installation must be engineered individually. However, the advantages and cost saving features are sufficiently attractive that any potential saving in either investment or daily operating cost is worthy of careful investigation. **—The End**

Many operators entering Appalachian Basin

Shallow Kentucky oil play, prolific west Pennsylvania Oriskany gas trigger new interest

By Harrison T. Brundage
Exploration Editor, WORLD OIL

MANY NEW OPERATORS are entering the Applachian Basin, spurred largely by the shallow oil boom in central Kentucky.[1] Among many other areas of interest, a prolific trend of Oriskany sandstone and Onondaga chert gas production has developed in recent years in western Pennsylvania and adjoining counties in West Virginia.[2] A highly prospective area in northeast Ohio is receiving increased attention for Cambro-Ordovician possibilities, and the recent discovery of gas in Cambrian beds in western Pennsylvania is encouraging.

New and improved methods of drilling, logging, production, formation treating and secondary recovery are coming into more common use.

Price structure stable. Crude oil prices tend to be higher in the Appalachian area than elsewhere in the United States because the local supply is limited and demand remains strong. Prices of natural gas are generally attractive also. Many pipe lines intersperse the eastern United States; any production found is apt to be located close to domestic and/or industrial markets. Prices range from 12 cents per thousand cubic feet to more than 32 cents. Generally, the farther north the gas is located, the better the price. Wellhead prices exceeding 32 cents per thousand cubic feet have been paid in New York state. This trend continues into eastern Canada; prices as high as 45 cents per thousand have been paid to producers in Ontario.

Many fields were missed. There seems to be no question that many oil and gas fields in the Appalachian Basin have been missed in previous drilling in times prior to modern logging, formation fracturing, acidizing, and other methods. This is not only true of the Appalachian province. The technique, however, stands to benefit the Appalachian province more than any other in the United States, because in almost all Appalachian productive formations, low permeability is a factor and a problem.

Of course, some formations respond better than others. In West Virginia, cases have been reported where only a faint show of oil was noted in the Big Injun sand. After fracture treatment, the same wells have come in at more than 200 barrels of oil per day. Fracture treatment has resulted in greatly improved oil production rates in the "Clinton" sand of eastern Ohio. Oriskany gas production generally has been enhanced greatly by hydraulic fracturing, with water coming into greater use in place of lease and diesel oil.

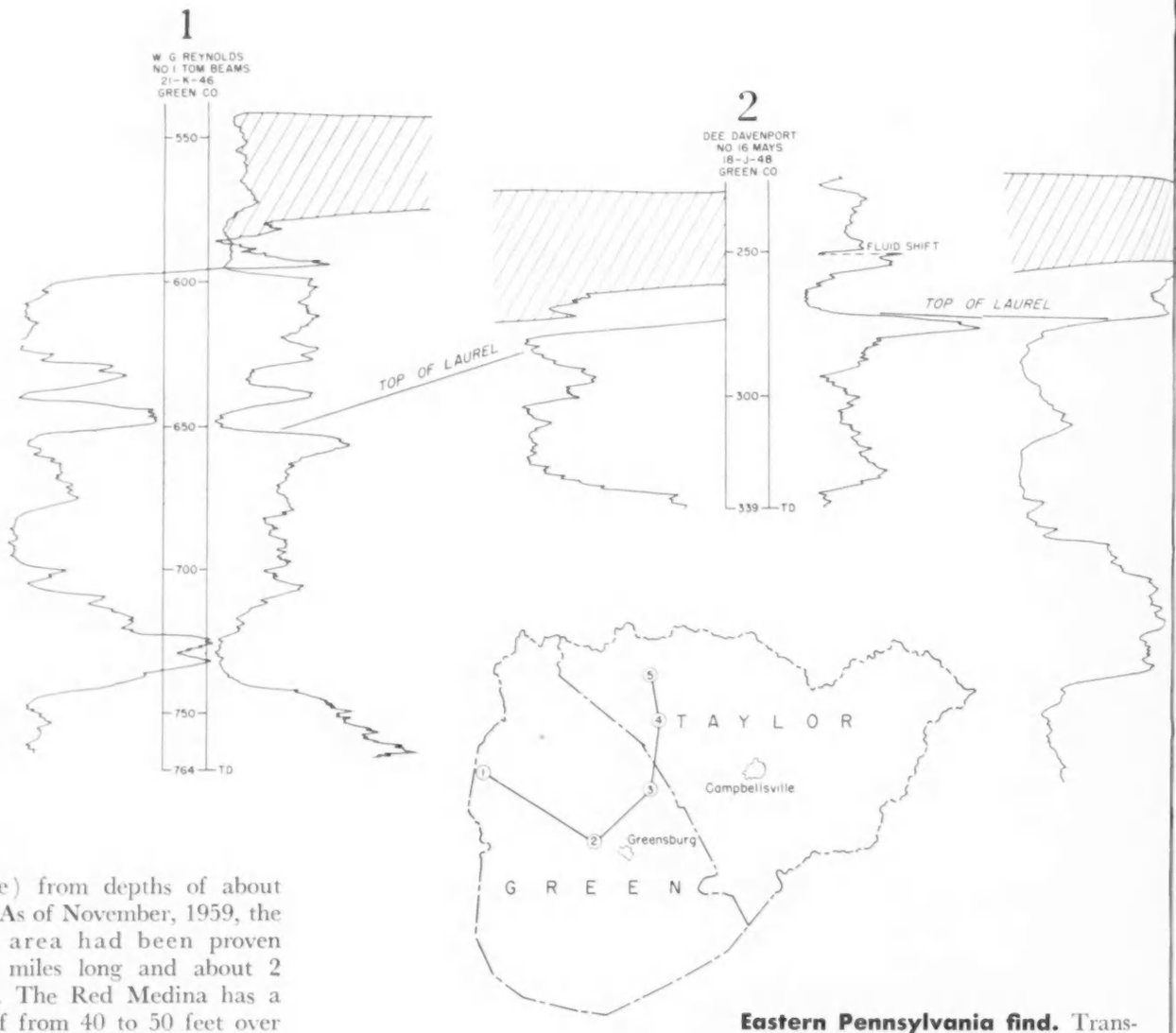
There apparently is little danger of causing water shutoffs due to swelling clays, although the Oriskany sandstone has been reported as bentonitic in some areas. Pronounced bentonite beds are reported in the Trenton limestone,[3] but this appears to be exceptional.

Good discovery rates. Historically, the Appalachian province has enjoyed good discovery rates compared to number of wells drilled. The main reason for this has been a tendency by operators to stay within more or less proven trends, coupled with the fact that in some areas, production covers most of the area of one or more counties. For instance, in the southern half of Wetzel County, West Virginia, the Gordon sandstone (Devonian) was originally productive almost everywhere, with gas on the anticlines and oil in the synclines. The Gordon did not produce salt water in this area. Dry holes resulted only from the sand being locally absent, or where it had no permeability. In some of the latter cases, a shot of high explosive would often bring the well in. In Lincoln County, southwestern West Virginia, where low-volume but long-lived shale gas production is the rule, there were 73 wells completed in 1956, with only one dry hole.

Deep pre-Devonian prospects have been virtually ignored, and will be sought in the future. One of the most promising exploration areas in the Appalachian province today is in northeastern Ohio and northwestern Pennsylvania, south of Lake Erie.

Pre-Oriskany possibilities of the Pennsylvania-Ohio border area were emphasized by an oil discovery near Conneaut, Ashtabula County, Ohio, in September 1957, when Benedum-Trees Oil Company Scribner 1 was completed for 150 barrels of 42° API gravity crude daily.[4] Since then, development of the field has shown it to be small and of minor importance.

More recently, however, an important gas field has been developed in Red Medina sands (Silurian) in the same vicinity. This is the Bushnell field, which produces from a stratigraphic trap (southerly dipping



monocline) from depths of about 3,100 feet. As of November, 1959, the productive area had been proven about 7½ miles long and about 2 miles wide. The Red Medina has a thickness of from 40 to 50 feet over most of the productive area. Natural open flows vary from 50,000 cubic feet to 5 million cubic feet daily. As elsewhere in the Medina or "Clinton" sandstones, formation fracturing may benefit open flow potentials of gas wells by as much as ten times the natural open flow (Table 1).

Though additional drilling will be required to define the exact productive trends to be found in this area, most geologists familiar with the problem agree that the indications are for good production in this region. The vicinity of Lake Erie and the northern Pennsylvania-Ohio boundary was a positive area in lower Cambrian time, causing lower Paleozoic strata to thin or to pinch out. A hinge area is believed to be present, with beds thickening downdip (eastward) toward the deeper part of the Appalachian Basin. Lockport, Medina, Trenton, and Gatesburg formations, among others, are thought to be highly prospective, as well as the shallower Oriskany and Onondaga beds.

Old ideas relating to hypothetical limits of new production to be found in the Appalachian Basin have received severe jolts in the past few years. During World War II, the first oil production in Virginia was found at Rose Hill in Lee County, Virginia, in fracture-porosity zones in the Trenton limestone below an overthrust plane. It is difficult to believe that Rose Hill will prove to be the only oil field lying east of the Appalachian structural front. Late last year a small oil discovery (8 barrels daily) was completed in Claiborne County, Tennessee, from Mississippian beds. The location is about equally far east, structurally speaking, as the Rose Hill field in Virginia. Details of the geological significance of the new find were being awaited.

Eastern Pennsylvania find. Transcontinental Production Company completed a negative Oriskany sandstone test early in 1956 at a location about 70 miles from any previous production, 10 miles west of Scranton and 4 miles from the edge of the anthracite coal fields. Dry gas was found in the silty shales of upper Devonian (probably Chemung) age at depths between 2,800 and 3,000 feet. There were also some shallower small gas zones.

A total of 12 wells was drilled (7 producers and 5 dry holes). Initial open flows in this field (called Harvey Lake) ranged from about 50 Mcf to 6,750 Mcf daily. Maximum rock pressure was 1,500 psi. Gas was marketed locally for 15 months, but production and pressures declined rapidly. The field has been shut in since February 1959.

Control of production appears to be stratigraphic, and the pays are probably lenticular. This is the easternmost gas production in the United

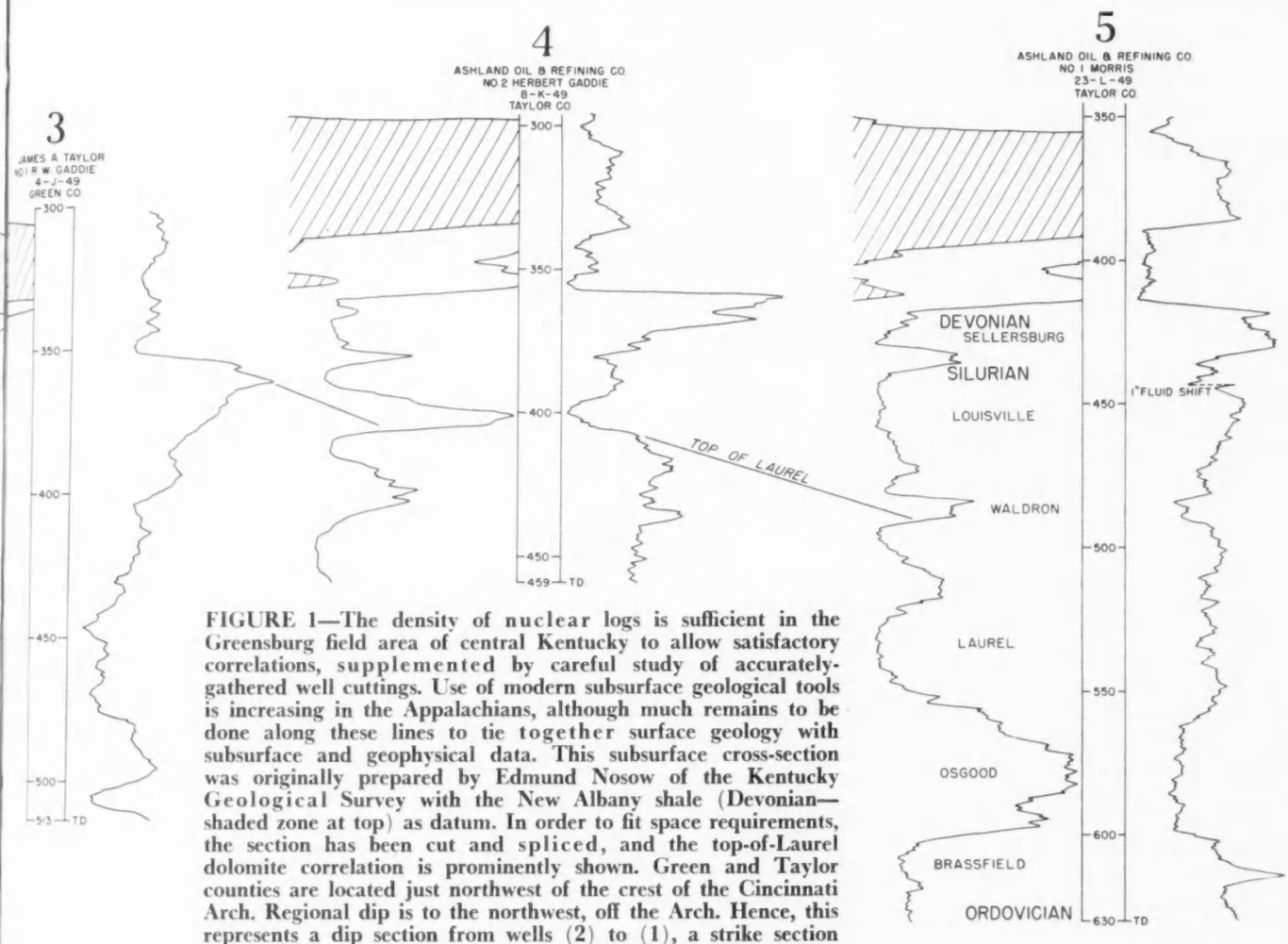


FIGURE 1—The density of nuclear logs is sufficient in the Greensburg field area of central Kentucky to allow satisfactory correlations, supplemented by careful study of accurately-gathered well cuttings. Use of modern subsurface geological tools is increasing in the Appalachians, although much remains to be done along these lines to tie together surface geology with subsurface and geophysical data. This subsurface cross-section was originally prepared by Edmund Nosow of the Kentucky Geological Survey with the New Albany shale (Devonian—shaded zone at top) as datum. In order to fit space requirements, the section has been cut and spliced, and the top-of-Laurel dolomite correlation is prominently shown. Green and Taylor counties are located just northwest of the crest of the Cincinnati Arch. Regional dip is to the northwest, off the Arch. Hence, this represents a dip section from wells (2) to (1), a strike section from (2) to (3), and a more or less oblique section through wells (3), (4) and (5). Evident on the section are the unconformity at the base of the New Albany shale, and pinchouts of lower Devonian and Silurian carbonate formations updip. These relationships are of great importance to entrapment of oil and gas in this region.

States. It is interesting in that it implies some relationship to the anthracite coal deposits; and the validity of the old carbon-ratio theory seems more questionable than before.

West Pennsylvania Oriskany. Lucrative gas fields continue to be found in western Pennsylvania,[2] in continuation of a trend that was spurred by the 1950 discovery of a major Oriskany sandstone gas field at Leidy, in Clinton County. The play has spread southward through Cameron, Clearfield, Indiana, Westmoreland, and Fayette counties, with gas being found in the Onondaga chert as well as the Oriskany. Hydraulic fracturing has been a big factor, particularly in the chert. With depths of 8,000 feet being commonly penetrated, rotary drilling has come into prominence in this area. Some of the surface structures are as long as 30 miles measured parallel to their axes. These structures are frequently overthrust from northwest to southeast, a factor that makes location of wells difficult and hazardous in spite of the fact that an essentially structural play has been taking place here. Tricky changes in the permeabilities and porosities also make it easy to pick drilling locations that prove dry. One company, with a reputation for careful preliminary geological work, nevertheless drilled six dry holes on one structure in this area. However, the seventh well found gas, and the succeeding five were successful also. As of the fall of 1957, the six producers had a combined open flow potential of 50 million cubic feet per day.

The western Pennsylvania trend of Oriskany production was being continued southward into eastern West Virginia, in Preston, Tucker and Randolph counties, and into Garrett County, in the Maryland Panhandle. Small Oriskany gas production has been established east of the Oriskany outcrop in a highly folded and faulted trend in Hampshire County, near Romney, W. Va., and in Rockingham County, Virginia.

In 1959, the Oriskany-Onondaga play in western Pennsylvania reached even more spectacular proportions. The Boone Mountain field was being developed in Clearfield County along the westward Oriskany pinchout on the east flank of the Sabinsville anticline. Available well control as of November 1959 indicated that Oriskany gas production might exist east-

TABLE 1—Approximate Maximum Benefit Ratios from Hydraulic Fracturing of Gas-Bearing "Clinton" Sandstones of Ohio

Natural Open Flow (Mcf Daily)	Maximum Ratio of Increase After Fracturing
0—50	55.1 to 1
50—100	14 to 1
100—200	11.7 to 1
200—500	5.3 to 1
500—or more	4.2 to 1

ward all the way across the Caledonia syncline. The drilling play was expected to extend well into Jefferson County to the southwest, and northeastward across Elk, through Cameron, and perhaps as far as Potter County. A gas-productive area as much as 60 miles long from southwest to northeast and several miles wide was envisioned.

The significant aspect of this development is that saddles between productive Appalachian structures in western Pennsylvania are not necessarily effective, and Oriskany gas production may occur in the intervening saddles as well as on the anticlines. Even larger gas reserves than those originally located at Leidy and Driftwood-Benezette fields may be found.

Of course, the new Oriskany-Onondaga fields are still subject to the drawbacks previously discussed;[2] namely, complicated structure, erratic permeability, and rapid exhaustion of Oriskany-Onondaga reserves once production has started.

However, even after depletion of an oil or gas field, some revenue may be realized from operation of it due to the strong demand in the eastern United States for expanded natural gas storage capacity. Completion methods for new wells are often designed not only for production but also for eventual gas storage. This is true of the Appalachian province generally, and of the western Pennsylvania area in particular.

In some areas, operators are even attempting to develop storage capacity in structures that have never produced hydrocarbons, such as the Washington Gas Light Company project to develop storage at Brandywine, Md., in Cretaceous sands about 1,500 feet in depth. This is important to exploration because, in effect, stratigraphic holes that might not otherwise be drilled are being completed for gas storage. It is possible that data on Cretaceous sands in Maryland may eventually have bearing on oil prospects along the Atlantic Coast, particularly offshore.

West Virginia "Clinton". A development that bears watching is the possibility of "Clinton" sandstone (Silurian) gas, and/or possibly oil, production in West Virginia. Except for some marginal gas in Roane County, West Virginia has yet to prove any "Clinton" production worth mentioning. This is so despite the trend of

TABLE 2—Index of Oriskany Sand and Onondaga Chert Pools, Chronologically by States

(Productive of gas unless otherwise indicated)

Structural Trap Pool—Stl Stratigraphic Trap Pool—Stc
Structural-Stratigraphic Trap Pool—SS

[1] Chert and Sand Production [2] Chert Production Only, to Date.

Map No.	Name of Pool—Field	State	County	Initial Completion	Type Accumulation
1	Mt. Lake Park	Maryland	Garrett	1949	Stl
2	Accident	Maryland	Garrett	1953	Stl
1	Wayne-Dundee	New York	Schuyler	1930	Stl
	Greenwood Field				
2	North Pool	New York	Steuben	1932	Stl
3	South Pool	New York	Steuben	1934	Stl
	State Line Field				
4	South Pool	New York, Pennsylvania	Allegany, Potter	1933	Stl
5	North Pool	New York, Pennsylvania	Allegany, Potter	1934	Stl
6	Allen	New York	Allegany	1933	SS
7	Howard	New York	Stueben	1937	SS
	Woodhull Field				
8	Woodhull Pool	New York	Steuben	1937	Stl
9	Tuscarora Pool	New York	Steuben	1944	Stl
10	Beech Hill	New York	Allegany	1938	Stl
11	Jasper	New York	Steuben	1939	Stl
12	Danby	New York	Tompkins	1939	Stl
13	Round Top	New York	Allegany	1939	Stl
14	Elmira	New York	Chemung	1940	Stl
	Independence Field				
15	North Pool	New York	Allegany	1940	Stl
16	South Pool	New York	Allegany	1938	Stl
17	Gilbert Hill	New York	Steuben	1940	Stl
18	Peruville	New York	Tompkins	1940	Stl
19	South Lansing	New York	Tompkins	1942	Stl
20	Bath	New York	Steuben	1947	SS
21	Allegany State Park	New York	Cattaraugus	1955	Stc
22	South Corning	New York	Steuben	(since 1956)	....
23	Monterey	New York	Steuben	(since 1956)	....
24	Ischua	New York	Cattaraugus	(since 1956)	....
1	Austinburg	Ohio	Ashtabula	1899	Stc
2	Concord	Ohio	Lake	1902	Stc
3	Geneva	Ohio	Ashtabula	?	Stc
4	Saybrook	Ohio	Ashtabula	1915	Stc
5	Mentor	Ohio	Lake	1915	Stc
6	Eaglesville	Ohio	Ashtabula	1919	Stc
7	Madison Lake	Ohio	Lake	1920	Stl
	Cambridge Field				
8	Cambridge Pool (Oil & Gas)	Ohio	Guernsey	1922	Stc
9	Knox Pool	Ohio	Guernsey	1925	Stc
10	Birds Run Pool	Ohio	Guernsey	1926	Stc
11	North Salem Pool (Oil & Gas)	Ohio	Guernsey-Tuscarawas	1927	Stc
12	Connesville Pool	Ohio	Coshocton	1929	Stc
13	Gilmore Pool	Ohio	Tuscarawas	1930	Stc
14	Norwich-Philo Pool (Oil)	Ohio	Muskingum	1930	Stc
15	Conneaut	Ohio	Ashtabula	1929	Stc
16	Green-Jackson	Ohio	Stark-Summit	1934	Stc
17	Jenkins-Columbia	Ohio	Columbiana	1935	Stl
	Dover Field				
18	Franklin Pool	Ohio	Tuscarawas	1937	Stc
19	Bolivar Pool	Ohio	Tuscarawas	1937	Stc
20	Beartown Pool	Ohio	Tuscarawas	1937	Stc
21	Paint Pool	Ohio	Holmes	1941	Stc
22	Sandyville Pool	Ohio	Stark-Tuscarawas	1943	Stc
23	Mayfield	Ohio	Cuyahoga	1941	SS
24	Hinckley-Granger	Ohio	Summit-Medina	1941	Stc
25	Richland	Ohio	Holmes	1941	Stc
26	Knox-Mahoning	Ohio	Mahoning-Columbiana	1944	SS
27	Ghent	Ohio	Summit	1946	Stc
28	Vernon (Oil & Gas)	Ohio	Trumbull	1946	Stc
29	Madison-Columbiana	Ohio	Columbiana	1946	Stl
30	Parma	Ohio	Cuyahoga	1948	SS
31	Boston	Ohio	Summit	1948	Stc
32	Belpre-Troy	Ohio	Athens-Washington	1951	Stc
1	Mt. Pleasant[2]	Pennsylvania	Westmoreland	1920	Stl
	Tioga Field				
2	West Pool	Pennsylvania	Tioga	1930	Stl
3	East Pool	Pennsylvania	Tioga	1931	Stl
4	Meeker Pool	Pennsylvania	Tioga	1931	Stl
	Hebron Field				
5	North Pool	Pennsylvania	Potter	1931	Stl
6	South Pool	Pennsylvania	Potter	1934	Stl
7	Wharton	Pennsylvania	Potter	1933	Stl
8	Ellisburg	Pennsylvania	Potter	1933	Stl
	Harrison Field				
9	East Pool	Pennsylvania, New York	Potter, Steuben	1934	Stl
10	West Pool	Pennsylvania	Potter	1935	Stl
11	Brookfield Pool	Pennsylvania, New York	Tioga, Steuben	1938	Stl
12	Sabinsville	Pennsylvania	Tioga	1935	Stl
13	Beaver	Pennsylvania	Beaver	1935	Stl
	Bingham Field				
14	West Pool	Pennsylvania	Potter	1936	Stl
15	Bingham Center Pool	Pennsylvania	Potter	1938	Stl
	Sharon Field				
16	North Pool	Pennsylvania	Potter	1938	Stl
17	Central Pool	Pennsylvania	Potter	1939	Stl
18	South Pool	Pennsylvania	Potter	1939	Stl

TABLE 2—Continued

Structural Trap Pool—Stl Stratigraphic Trap Pool—Stc
Structural-Stratigraphic Trap Pool—SS
[1] Chert and Sand Production [2] Chert Production Only, to Date.

Map No.	Name of Pool—Field	State	County	Initial Completion	Type Accumulation
19	Ulysses	Pennsylvania	Potter	1939	Stl
20	Summit	Pennsylvania	Erie	1946	SS
21	Unity (One Small Well)	Pennsylvania	Westmoreland	1946	Stl
	Uniontown Field[1]				
22	North Pool	Pennsylvania	Fayette	1937	Stl
23	South Pool	Pennsylvania	Fayette	1941	Stl
	Leidy Field				
24	Central Pool	Pennsylvania	Clinton	1950	Stl
25	North Pool	Pennsylvania	Clinton	1951	Stl
26	Tamarack Pool	Pennsylvania	Clinton	1952	Stl
27	Greenlick Pool	Pennsylvania	Clinton & Potter	1955	Stl
	Driftwood-Benezette Field				
28	East Pool	Pennsylvania	Cameron	1951	Stl
29	West Pool	Pennsylvania	Elk and Clearfield	1953	Stl
30	Bell[2]	Pennsylvania	Clearfield, Jefferson, & Indiana	1953	Stl
31	Pine[2]	Pennsylvania	Indiana	1954	Stl
32	Rockton-Luthersburg[1]	Pennsylvania	Indiana & Clearfield	1955	
33	Jacksonville[1]	Pennsylvania	Indiana	1956	Stl
34	Johnstown[2]	Pennsylvania	Westmoreland & Somerset	1957	Stl
35	Boswell	Pennsylvania	Somerset	(since 1956)	Stl
36	Boone Mountain	Pennsylvania	Jefferson, Clearfield, & Elk	(since 1956)	SS
37	Donegal-Cook	Pennsylvania	Westmoreland	(since 1956)	Stl
1	Bergton	Virginia	Rockingham	1951	Stl
	Jackson-Kanawha Field				
1	Campbell Creek	West Virginia	Kanawha	1930	Stc
2	Jackson-Kanawha	West Virginia	Jackson, Putnam, & Kanawha	1934	Stc
3	Bull Creek	West Virginia	Kanawha	1937	Stc
4	Elk-Kanawha	West Virginia	Kanawha	1944	SS
5	Limestone Hill	West Virginia	Wood-Wirt	1947	Stc
6	Freemansburg	West Virginia	Lewis	1941	Stl
7	Davis	West Virginia	Tucker	1944	Stl
8	Terra Alta	West Virginia	Preston	1945	Stl
9	Pifer Mountain	West Virginia	Tucker	1954	Stl
10	Glady	West Virginia	Randolph	1954	Stl

A total of 106 Oriskany and/or Onondaga gas fields are listed here by states in chronological order of discovery. The numbering (by states) corresponds to map numbers (Figure 2). Included are 2 fields in Maryland, 24 in New York, 32 in Ohio, 37 in Pennsylvania, 1 in Virginia, and 10 in West Virginia. Exploration for more Oriskany-Onondaga fields is proceeding farther south in eastern West Virginia and farther east in Pennsylvania.

oil and gas production from this horizon, extending about 200 miles north-south through eastern Ohio.

Several deep wildcats in West Virginia have tested substantial flows of gas from the "Clinton" in recent years, but analysis showed the gas to have such high proportions of carbon dioxide and inerts as to be useless for fuel. It is thought, however, that this is a local (vertical) condition, not a regional (horizontal) one. No such problem exists through 200 miles of the "Clinton" trend in Ohio.

Extension of central Kentucky play. Many new operators from all over the United States are flocking to central Kentucky[1] following the Greensburg field oil boom.

The Greensburg oil discovery renewed interest in an old trend that has yielded production since Civil War days. The discovery is only a short distance downdip from an extensive gas field which was discovered during World War I.

It is important to note that most of the recently found fields in Kentucky are very close to old gas fields. This is true of both Greensburg and Knob Lick. LeGrande oil pool, located directly downdip from the Center gas pool, has produced about 4 million barrels. On the east flank of the Cincinnati Arch in Clinton County, the Decide pool has a small gas cap in the northern part of the field.

Pay zones are discontinuous. Few producing horizons can be expected to continue for long distances in central Kentucky without a facies change. This is a trait of Appalachian formations generally. Structure plays a minor role in oil and gas accumulation—permeability and porosity traps are of prime importance.

Silurian strata on the west flank of the Cincinnati Arch are found in Kentucky as far north as Oldham County, and favorable facies in Laurel and Brassfield dolomites occur at least as far north as Bardstown in Nelson County.[5] However, the Laurel dolomite facies is not expected to continue very far south into Tennessee.

Greensburg field is located in a structural sag, where the Rough Creek fault system crosses Kentucky from Illinois toward the Cincinnati Arch. The northern limit of the field is determined by a fault of about 175 feet of throw, downthrown to the south. Greensburg's relatively low structural position represents another similarity to the Decide pool of Clinton County, previously mentioned.

Regional marker. An oolitic (sometimes pseudo-oolitic) zone at the *top of the Laurel dolomite* has been recognized in samples as far north as Nelson County, Kentucky,[5] and as far south as Sumner and Robertson counties, Tennessee. This marker zone is generally recognizable throughout Greensburg field. It is a good one for geologists working in this trend to learn to recognize.

Tennessee has a variety of prospects. State geologists are optimistic about Trenton limestone possibilities on the northwest flank of the Nashville Dome, and also regarding Ste. Genevieve (Mississippian) oolite prospects in various parts of the state, particularly in the upper northern plateau area. A good oil discovery in the Knox dolomite anywhere in the state or in Kentucky would doubtless quicken new deep drilling activity in both states.

Tennessee surface geology has been worked fairly thoroughly, especially since the state has extensive coal and phosphate industries. The state has enacted petroleum legislation intended to prevent the rather chaotic well-spacing and production situation existing in central Kentucky and in certain other Appalachian areas.

APPALACHIAN PROVINCE HAS DRAWBACKS

Of course, the Appalachian Basin has numerous drawbacks, as well as advantages. Payouts of producing wells tend to be slow. Low-volume, long-lived wells are the rule in the Appalachian Paleozoic pays. The Oriskany sandstone is a very striking exception to this general rule.

Geological information often not accurate. There is a tremendous volume of geological information available that has accumulated through the years. However, very little readily-available subsurface information is accurate enough to serve as a basis

FIGURE 2—This map of the northern portion of the Appalachian Basin shows the location of more than 100 gas fields producing from Oriskany and Onondaga formations. Production in eastern Ohio is strikingly related to the Oriskany sandstone feather-edge. In western Pennsylvania and east West Virginia, structural trends are important to Oriskany-Onondaga accumulations, although stratigraphy plays a part also. The fields shown here are identified by number in Table 2.

for a good geological exploration program. The reason for this is simple: the success ratio for wells drilled to follow specific trends in proven areas has been so good that it has usually been difficult to justify careful selection of drillsites, and careful recording of subsurface data. Many Appalachian operators have not even bothered to determine accurate elevations on their wells. This is in spite of the fact that U.S. Geodetic Survey ground control is generally good and well monumented through the Appalachian province.

Cable tool holes, though usually fairly straight at shallow depths, say to 1,000 feet or so, tend to deviate considerably in deeper holes.

Obviously it is essential that more operators run straight hole surveys to determine what the deviation from vertical is in each new well, before electrical induction and radioactivity logs can have the precise geological meaning of which they are capable.

It is important that more operators make a practice of running induction and/or radioactivity logs in cable tool holes, as well as electrical logs in mudded rotary holes.

But it often is hard to justify running modern-type logs in areas where there are no similar ones to correlate with—and this situation applies to the vast majority of Appalachian drillsites.

Until such time as there are enough modern-type logs run in wells, the surface elevations and subsurface deviations from vertical of which are accurately known, and the sample logs of which have been carefully and accurately posted and correlated by geologists, the Appalachian petroleum literature will continue to be a jumble of local names and regional miscorrelations. There is simply not enough accurate subsurface information available to tie in surface geological correlations (many of which are quite accurate) with subsurface data. This situation tends to impede and impair effective exploration for oil and gas in the eastern U.S.

J. R. Lockett wrote,[6] "Early in 1887, a well located in the city of Lancaster, Fairfield County (Ohio) which had been planned to test the Trenton, encountered gas at a depth of less than 2,000 feet in a sandstone thought to be of Silurian age. The new producing horizon was arbitrarily named the 'Clinton' . . . the term 'Clinton' as used herein refers to the Silurian sandstone which produces petroleum and natural gas in eastern Ohio and which possibly is not a member of the Clinton formation."

A number of geologists close to the problem think that the "Clinton" of eastern Ohio correlates with the Red Medina or Grimsby sandstone of western New York State. Bryson C. Donnan[7] apparently equates the "Clinton" in Ontario with the Thorold, above both the Grimsby and Whirlpool sandstones. P. H. Price et al[8] wrote "The Clinton sand is the Tuscarora or White Medina sandstone, at the base of the Silurian."

The "Clinton" correlation is merely one of the many subsurface correlations giving concern to Appalachian oil men, though it is one of the better examples. Drillers' logs are full of such inexact or loosely applied terms as "hard rock," "flint," "jingle rock," "grit," and "stray sand." Geologic

work used on such logs can hardly be expected to be any more accurate.

One service company operating in the Appalachians is running nuclear logs in some cases free of charge to some operators of strategically-located cable tool wildcats. Often an operator has evaluated a dry cable tool hole well enough so that the expenditure of additional money for logging cannot be justified. However, the location may be considered important enough to the logging firm in view of additional wildcats to be drilled in the future along the same trend. If a good network of log control can be developed, exploration in the Appalachians can be put on a more scientific and economic basis.

An aerial survey company recently announced a program to provide magnetometer coverage on 121,500 square miles in the Appalachian Basin, including parts of New York, Pennsylvania, Maryland, Virginia, West Virginia, Kentucky, Ohio, and offshore Lake Erie. Similar to the wildcat spot-logging discussed previously, this work is being undertaken by the aerial firm to promote both business and better understanding of Appalachian geology.

For some time, however, acquisition of good subsurface geological data in the Appalachians will have to be conducted on a do-it-yourself basis. This places new firms entering the Appalachians at a serious competitive disadvantage to those which have been operating profitably in the province for many years, acquiring good files of reliable data over a long period of time.

Dangers of "town-lot" drilling. Town lot drilling is another bugaboo facing operators in the Appalachian province, particularly in Pennsylvania. A bad example of cut-throat competitive drilling occurred in 1952-53 in Driftwood, Pa., where a number of wells were drilled on one-acre plots to tap Oriskany gas at about 7,600 feet. The problem is particularly ominous in the Oriskany trend, since gas production tends to be so short-lived there.

State agencies are generally in favor of compulsory unitization laws. A clause in New York State Natural Gas Corporation's leases in Lake Erie[4] (requiring the company to attempt to unitize with offset operators to avoid drilling an excessive number of wells) reflects this attitude. But small landowners and small independent operators generally are against compulsory unitization, and the idea has little grassroots political appeal. Larger gas producers are reluctant to try to lobby such bills through legislatures for fear of antagonizing independent producers from whom they buy gas.

Operators in the area will simply have to live with the problem. Strenuous efforts to acquire all tracts, large and small, on a prospect, before drilling commences, are essential, to avoid a situation where an operator is legally forced to drill many closely spaced offset wells, in violation of all sensible conservation principles.

Much prospective acreage held by production. Much acreage in the Appalachians is held by shallow production, which will continue in slowly decreasing quantities for many years. However, it should be possible to work out trades and deals for assignments of the pertinent deep rights when this is necessary to accumulate a large enough block to justify a deep test, and where producers holding leases have no intention of drilling for deep formations.

Some original leases on structures in Pennsylvania have abnormally long primary terms—often 20 years—and are of fairly recent vintage.

Appalachian pitfalls. Operators entering the Appalachian province from other U. S. areas should bear in mind that they are apt to operate in a far different fashion than they have been accustomed to at home. In the first place, hard rock starts just below the grass roots at most Appalachian drillsites. For that reason, cable tools can often be expected to be more economical for surface and shallow holes than rotary rigs. Air drilling is coming into prominence, and as deeper drilling becomes more widespread, rotary activity is increasing.

Enough has been said about subsurface information to behoove operators to beware of second-hand geological data and to do everything in their power to promote the use of modern subsurface geological tools in the Appalachians. However, a point that cannot be stressed too strongly is that *stratigraphy is more important than structure* in the accumulation of oil and gas in the Appalachians. Permeability trends, fracture zones, cementation of fractures, dolomitization of limestones, and related factors are more important than reliance on structures.

Of course, careful attention should be paid to structural relationships.

Seismic work may be helpful in ascertaining the best locations for deep tests on Appalachian structures, which are frequently overthrust, such that a well can be changed from favorable structural position to unfavorable when a fault plane is penetrated. Some studies have been made of seismic velocities, and more velocity checks in deep tests should prove very helpful in furthering the search for deep oil and gas. The need is particularly great because at least three, and perhaps four major orogenies affected Paleozoic sediments in the Appalachians.[9] The structural patterns dating to the several disturbances do not coincide. This situation greatly complicates the search for oil and gas.

In 1955, Hope Natural Gas Company et al drilled a deep test on the Burning Springs Anticline in Wood County, West Virginia. The well penetrated the entire Paleozoic section and entered basement rocks at 13,276 feet. Numerous shows were encountered in the section, including a trace of gas at 13,264 feet. Sediments with interesting potential reservoir characteristics, including dolomites with vugs approaching the size of a man's fist, were cored.[3]

However, the Burning Springs structure is now known to be faulted. The Oriskany sand was encountered three times during the drilling of the upper part of the hole. Whereas the upper section was highly disturbed, the lower Paleozoic beds were not. It is very possible that this deep test, which has been studied from almost every possible surface angle, was off structure at depth.

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Implosion technique improves fracturing performance

Hollow glass capsules opposite dense, tight pay zones clean the sand face and initiate fractures. Conventional hydraulic fracturing job then can be performed at reduced pressures

By Donald D. Setser
Development Engineer
Dowell Division of The Dow Chemical Co., Tulsa

A NEW WELL stimulation technique designed to reduce surface treating pressures during conventional hydraulic fracturing of dense tight formations has been introduced. Hollow glass capsules are spotted opposite the potential producing interval and are collapsed or "imploded" by hydrostatic head plus pressure obtained with surface pumping equipment.

As the implosion occurs, the inward rush of fluid into the void space previously occupied by the capsule pulls debris from the formation thus providing a cleaning action for the perforations and the sand face. A high-pressure surge of short duration follows the implosion and serves to initiate fractures in the producing interval. A conventional hydraulic fracturing treatment then is performed to complete the job.

Field experience indicates the following advantages if a conventional hydraulic fracturing treatment is preceded by an implosion treatment:

- Conventional fracturing treatments are performed at lower surface injection pressures than are normally required.
- A larger quantity of sand may be injected into the formation at higher rates.
- Selective fracturing without additional downhole equipment is possible.
- Use of the implosion technique in conjunction with conventional fracturing treatments has made possible selective stimulation of many dense, tight formations which previously have not responded well to hydraulic fracturing treatment only.

Many different well stimulation methods have been devised for increasing the injectivity or productivity of oil and gas wells. In general, these treating techniques fall into three broad classifications: explosives, chemicals and hydraulic pressure. A new development in this third category is the use of implosion capsules which are designed to provide selective stimulation of formations that are difficult to treat with conventional techniques.

The principal explosive techniques are nitro-shooting and both bullet and jet perforating. Chemical treating techniques include use of acids, surfactants, organic solvents, etc. During recent years, hydraulic pressure has been used extensively to open and extend fractures into the matrix.

FIGURE 1—Two examples of specially designed glass capsules used with the implosion stimulation technique.

In some cases, the pressure required to fracture a formation exceeds the safety factor of the well casing and tubing and packer must be run in the well to confine the high pressures applied during the treatment. This not only increases the job cost, but introduces additional difficulties.

Friction losses experienced in pumping fracturing fluids down a well at high pressure are increased when the treatment must be performed through tubing. To overcome these difficulties which are commonly encountered in dense, tight formations, the implosion technique was developed to lower surface treating pressures during subsequent fracturing operations.

Everyone is familiar with the phenomenon of explosion. Here, the sudden generation or release of an extremely high-pressure nucleus results in rapid expansion into a surrounding, lower-pressure medium. In contrast, an implosion is the movement of a high-pressure surrounding medium into a low-pressure nucleus.

In any situation where there is a differential pressure across a restrictive boundary, the higher pressure will try to escape into the lower pressure area, until they are equalized. If such a boundary is suddenly removed, the resulting pressure equalization may take place with destructive violence.

In well stimulation treatments, the implosion technique utilizes specially designed glass capsules (Figure 1). The wall of the capsule is the boundary that separates the high pressure

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fluid in the well bore (resulting from hydrostatic head plus additional pressure applied by pumping equipment at the surface) from the low pressure interior of the capsule. When a capsule is collapsed in a well bore, the section of the formation immediately adjacent to the capsule is strongly affected by the resulting implosion.

When an explosion is initiated in a well bore, the liberated force radiates outward spherically, producing positive pressure increases over the entire extent of the bore hole. When an implosion is produced, there is an initial decrease in pressure, followed by a surge of increased pressure. The area of maximum effect is immediately adjacent to the imploding capsule. This maximum force radiates outward in a horizontal radial plane into the formation.

Procedure. The implosion treatment is performed as follows. The implosion capsule, or capsules, are suspended by wireline or tubing at the depth where maximum force is to be applied (Figure 2). The surrounding fluid in the well bore then is pressurized until the yield-point of the glass capsule is exceeded. The capsule collapses and the implosion takes place. There is an immediate inward rush of the surrounding high-pressure fluid into the low-pressure void left by the glass capsule.

Considerable force is released when one of these glass capsules is imploded. For example, if 2,500 psi is required to callapse the capsule, then the differential pressure will be 2,500 psi at the instant the capsule wall breaks. The release of this pressure causes the fluid to move into the cavity at a velocity of approximately 600 fps, pulling debris from the formation along with it and cleaning the face of the formation and adjacent flow channels.

Pressure surge. The second phase of the reaction is an extremely high pressure surge of short duration. This pressure is produced by the impacting inertial force of the inrushing fluid. These pressures, calculated from the mass-velocity relationship of the moving fluid and experimentally verified, are shown in Figure 3.

The pressure surge resulting from the implosion is directly related to the initial pressure required to collapse

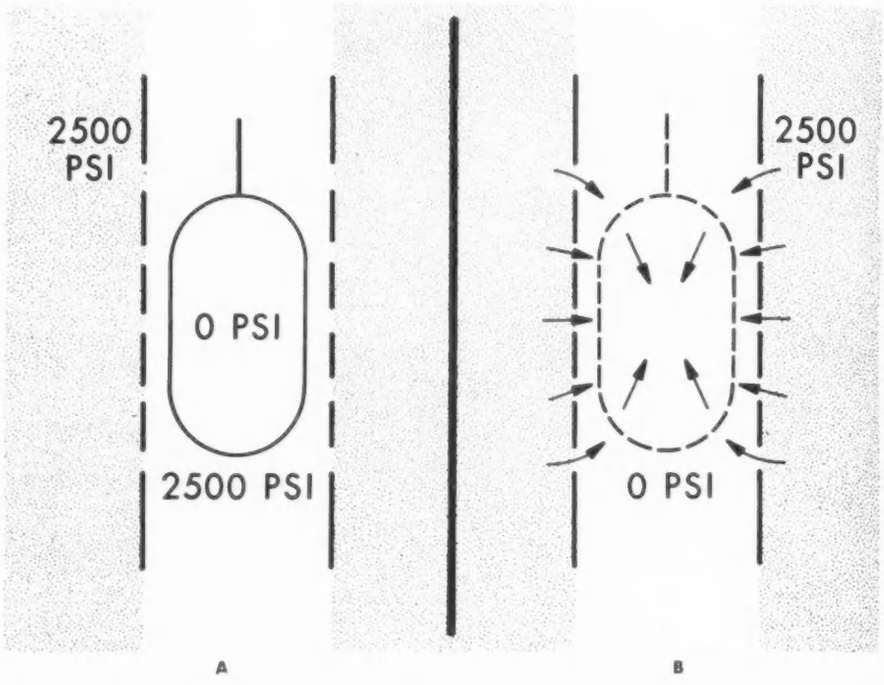

FIGURE 2—This schematic drawing illustrates the implosion technique. In Figure 2A, the hollow cylindrical glass capsule is spotted by wireline or tubing opposite the zone of interest and pump pressure is applied at the surface. In Figure 2B, the collapse pressure of the capsule has been exceeded and the capsule "implodes," drawing fluid into the void space and cleaning the sand face. Figure 2C indicates

the capsule. The system may be visualized as a large spring in which energy can be stored. As pressure is increased inside the casing and well bore, the casing expands and the fluid compresses, thus storing energy. The potential energy of the column of fluid, above the point at which the capsule is suspended, can be calculated.

For example, the hydrostatic head acting against a 4-inch x 24-inch capsule suspended in water in 5½-inch casing at a depth of 2,500 feet, would be about 1,082 psi. The internal cross-sectional area of the casing is 19.6 square inches. Hence, the total weight of the fluid column, inside the casing and above the capsule, would be 19.6 x 1,082 = 21,200 pounds. It may be seen that this column of water, suspended at a height of 2 feet, would have a potential energy of 42,400 foot-pounds. However, during an implosion treatment, the total energy in the system is greater than this because of the additional pressure applied by surface pumping equipment to collapse the capsule.

When the capsule collapses, the surrounding fluid starts to move into the cavity as shown in Figure 2. This movement is accompanied by a drop in pressure throughout the well bore to the surface, indicating that the entire fluid column is moving downward. When the cavity is filled, the inertial force of the moving fluid column is expended when it can travel no further. The resulting pressure

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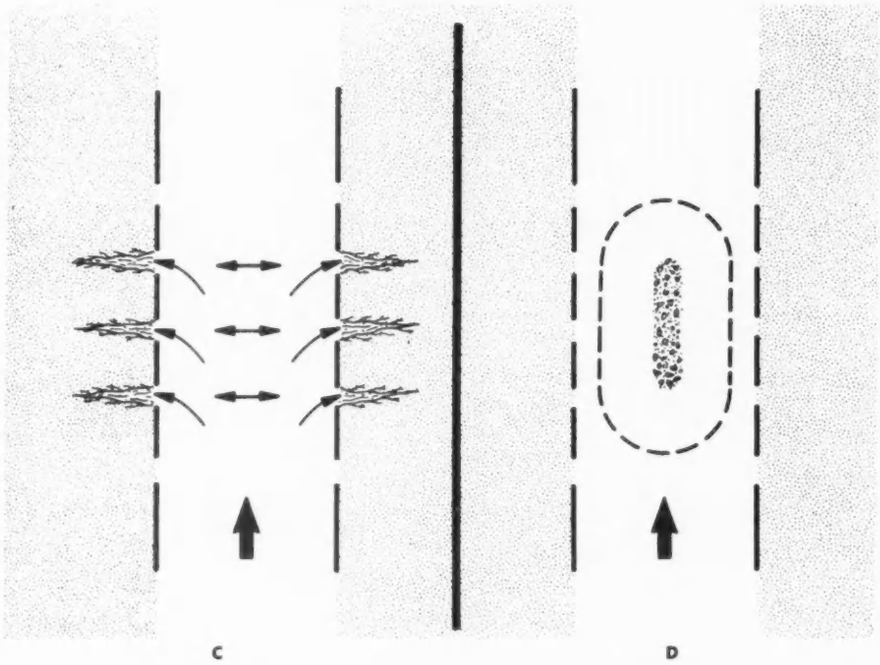

that the first phase of implosion is about complete and that a high pressure surge produced by the impacting inertial force of the inrushing fluid is about to begin. In Figure 2D, the high pressure surge acts on the formation and initiates fractures. A conventional hydraulic fracture treatment completes the job.

surge is produced in the space originally occupied by the capsule, and is prolonged until all fluid movement has stopped.

Most of the kinetic energy released when the cavity collapses is directed against the relatively small area of the formation adjacent to the imploding capsule. If this force exceeds the tensile and compressive strength of the matrix rock, it should initiate fractures in this area.

In a normal fracturing operation, hydraulic pressure is increased equally over the entire exposed formation until it parts. This fracture usually occurs at the weakest point. In many cases, the fracturing materials injected into the formation will be diverted into this single fracture, which may not be in the productive zone. By preceding a fracturing treatment with an implosion at the desired depth, the force of the implosion may initiate fractures so that the subsequent fracturing materials will be injected into the proper zone.

In conducting this type of combination treatment ,capsules are selected that will implode at a lower pressure than that required to fracture the formation. As additional fluid is pumped into the well, pressure rises until implosion occurs. The capsule then collapses and the fluid in the upper well bore moves downward into the cavity. At the point of impact of the upper and lower fluid columns, the pressure surge developed shatters the adjacent formation (Figure 2).

Fractures developed by this technique should be larger and more numerous than those produced by a conventional fracturing treatment because of the high-velocity outward movement of the fluid which occurs while the forces are equalizing. Multiple fractures should result at the desired depth because of this radially directed force. Comparison of treating pressures required to fracture various wells with and without an implosion pre-treatment, during experimental studies, has shown this to be the case. Also, debris recovered from wells after implosion treatments showed that the formation face had been shattered.

Example. An experimental treatment was performed on a gas well in Coshocton County, Ohio, producing from the First Berea formation. This formation is a tight sand, usually found at about 1,000 feet. Previous attempts to fracture it using pressures in excess of 3,000 psig had failed.

This well had been newly completed and was producing about 20 Mcfd when a two-stage implosion treatment was performed. The first capsule was intended to clean off the face of the formation, and the second capsule to initiate a fracture in this zone.

A 4-inch x 48-inch capsule was suspended in the well opposite the zone of interest and the hole was loaded with water. A hydrostatic head of 1,000 feet of water was sufficient to kill the well. A surface pump pressure of 1,850 psig then was applied, causing the capsule to implode. After pressure was bled off, all water was unloaded from the well. This indicated

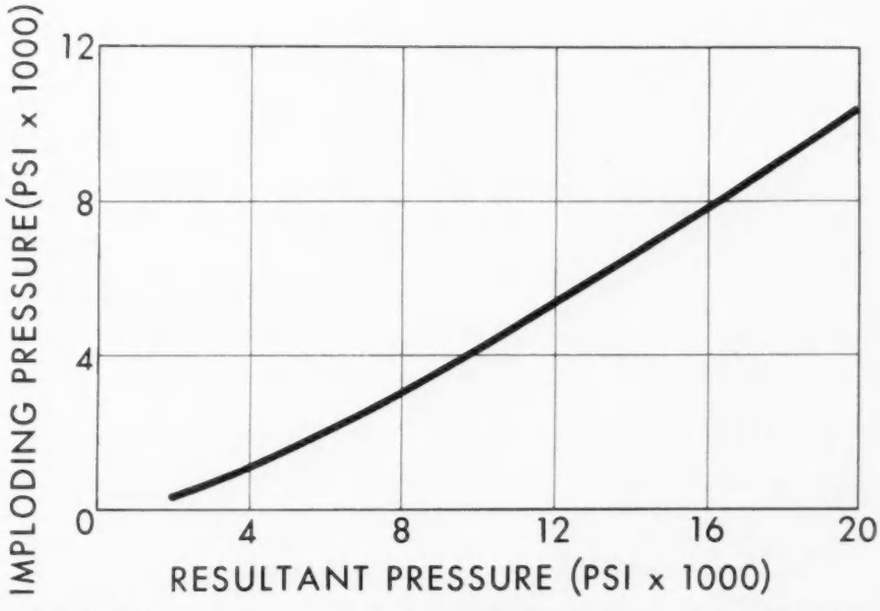

FIGURE 3—The resultant pressure surge following implosion can be determined from this curve. Data for the curve were calculated from the mass velocity relationship of the moving fluid and experimentally verified.

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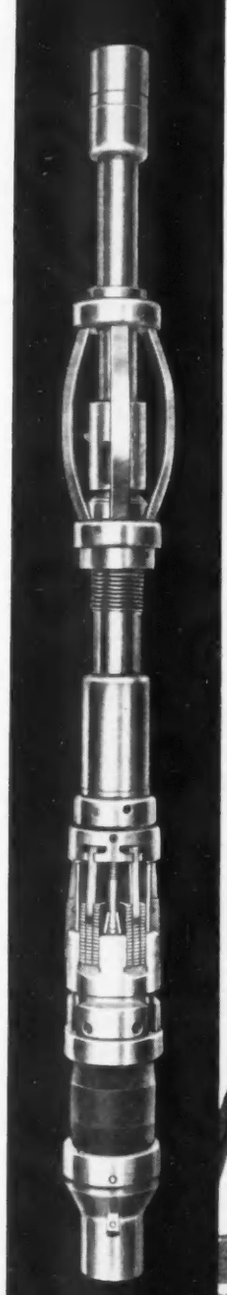

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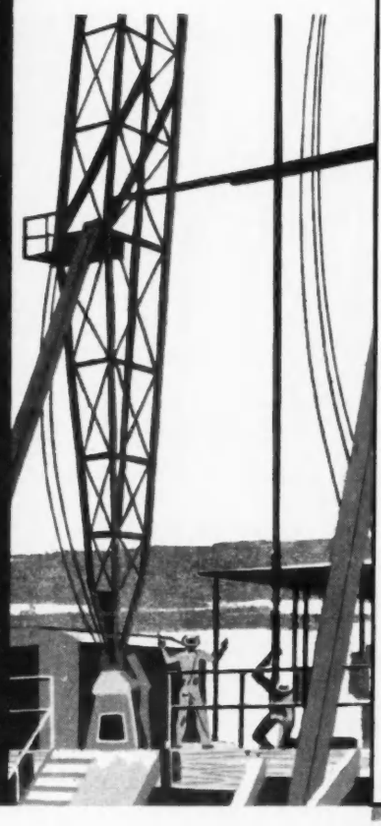

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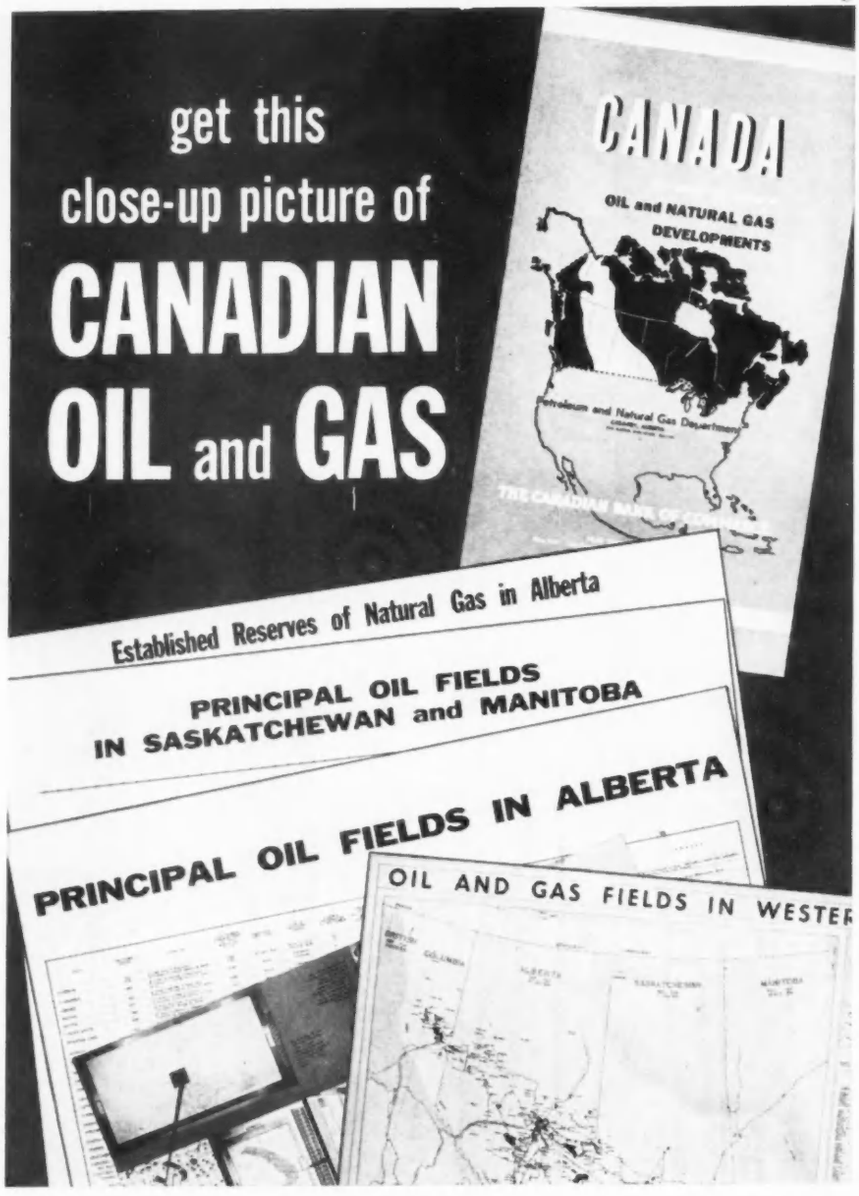

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About the Author

Donald D. Setser is a graduate of the University of Tulsa, with a B.S. degree in physics. He joined Dowell in 1946 in the Engineering Research Department. In 1953 he was promoted to development engineer, and subsequently served for three years in the Service Development Department. In 1958 he was transferred to his present position in the Mechanical Research Laboratory. His headquarters are at the company's general offices in Tulsa.

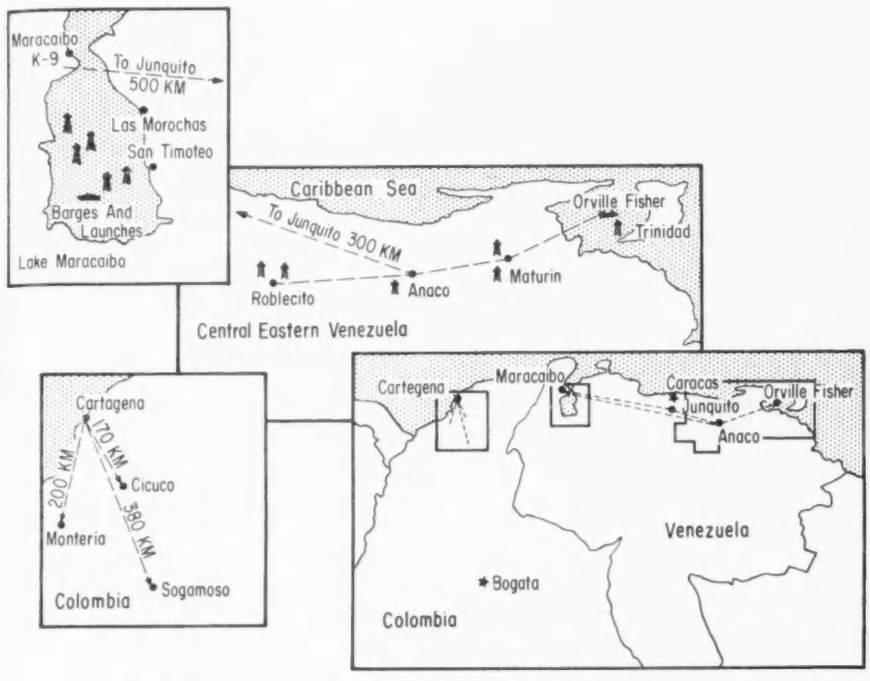
that blocked formation flow channels had been cleaned out.

A second capsule (4-inch x 24-inch) requiring a surface pressure of 2,000 psig for implosion, was spotted at the same point in the well bore. The well again was loaded with water and pressurized to 2,000 psig. At this pressure, the pumping rate was less than ½ bpm. When implosion occurred, pressure dropped to 700 psig at the same pump rate. A test showed that injection then was possible at a rate of 5 bpm at 1,600 psig, indicating that fracturing had occurred. No further treatment was performed.

Two days later the wel lwas gauged at 57 Mcfd. A fracturing treatment then was performed in which 5,000 pounds of sand was pumped into the formation. Production after this treatment increased to 225 Mcfd. This was the first successful fracturing treatment in this area placing sand in this difficult formation.

Similar results have been obtained on other tests using the implosion technique. Formations which have been tested to date with implosion capsules include the First Berea, Silurian dolomite, Oriskany, Arbuckle dolomite, San Andres, Tar Springs sand, Devonian lime, Ellenburger lime, Queens sand and the New Castle.

(This article is excerpted from a paper presented to the annual meeting of the Ohio Oil and Gas Association at Columbus, Ohio, on February 26, 1960.)



Maps show radio network which Loffland Brothers Company operates in Venezuela and Colombia to maintain contact between widely scattered rigs and camps.

Radio links South American fields with headquarters

By Anthony Gibbon
Mid-Continent District Editor

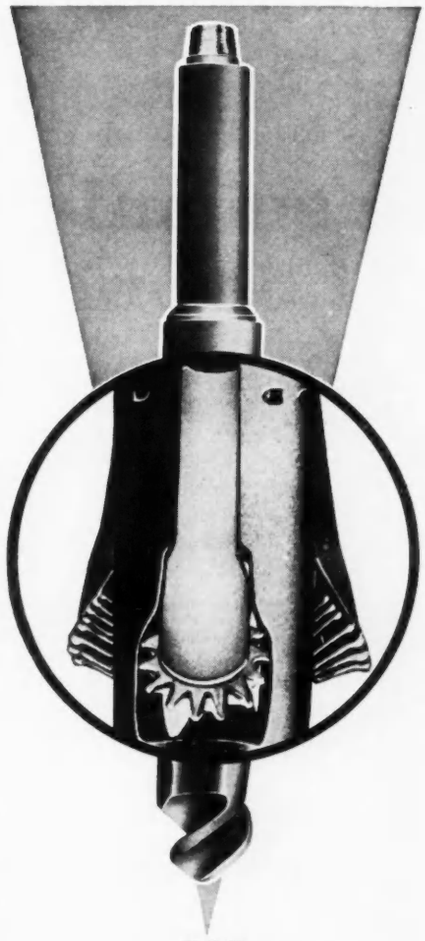
LOFFLAND BROTHERS Company, international drilling contractors, recently completed installation of new radio and micro-wave facilities in Venezuela and Colombia. The new links permit uninterrupted radio communications between company headquarters in both countries and rigs, camps, marine installations and automobiles in the field. These facilities represent an unusually long and large integrated communication network for a drilling contractor.

From the Gulf of Paria in eastern Venezuela to rigs operating in northwestern Colombia, the network spans communications gaps over some 2,000 miles of terrain, much of it wild and unsettled. Only through radio can the company maintain direct contact with its far flung operations.

The effectiveness of the radio system can best be described by noting how the system serves as a time saver. In the Maracaibo area, the nearest land rig is approximately a two hour drive from Maracaibo. The nearest lake barge is approximately three hours by crew launch from Maracaibo. In Eastern Venezuela, where Loffland's rigs are drilling in the Gulf of Paria, supplies come from Anaco. Travel time from Anaco to the Gulf of Paria is approximately 14 hours.

In instances where equipment has to be shipped from Maracaibo to Anaco or Anaco to Maracaibo, overland travel takes 18 hours. By air, it takes five hours. In bad weather travel time is even longer.

Considering these distances in a matter of travel time, it is quite obvious how important the radio net has become in reducing lost time. In a matter of minutes supplies from one



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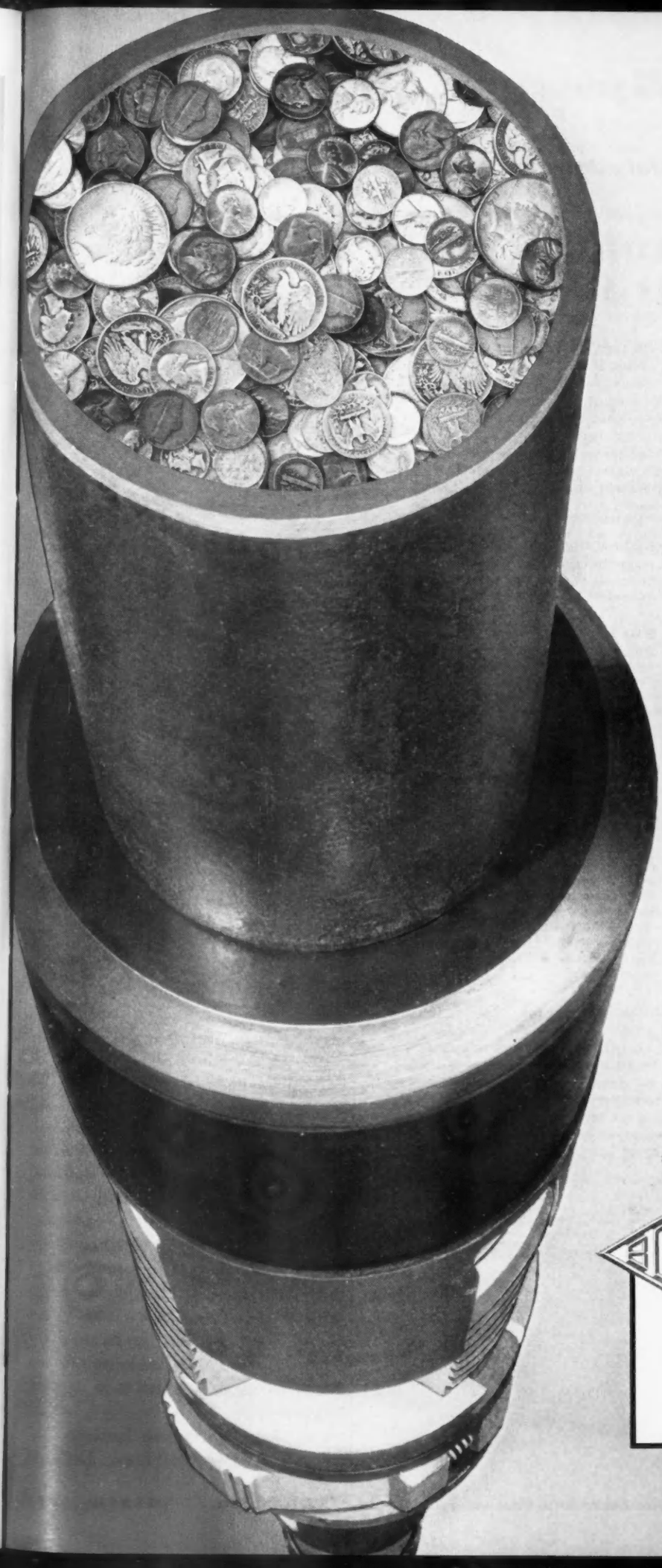
The need for extending its communications system became necessary when Loffland Brothers Company expanded its operations in eastern Venezuela in both directions from Anaco,



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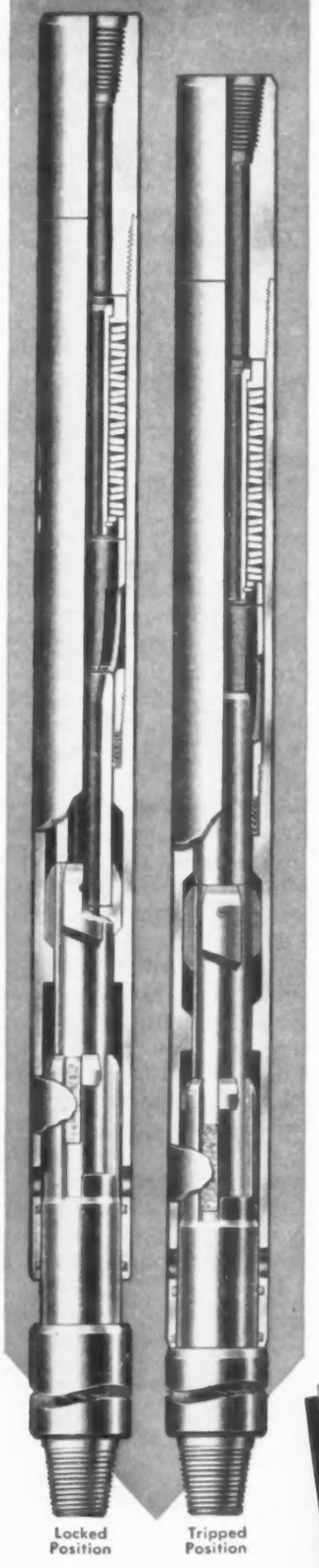
Positive JAR-DOWN ACTION ***. . . plus Safety Joint protection!***

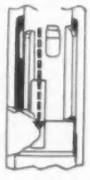


See the Shaffer section of your Composite Catalog.

THE SHAFFER-WAGGENER BUMPER SAFETY JOINT

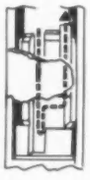
There is no other tool like the Shaffer-Waggener Bumper Safety Joint. It combines—in ONE tool—a choice of *jar-down* and *releasing* actions, both under complete control of the operator. What's more, the tool is so rugged it is run as part of the drill string to protect against stuck pipe.

In actual well service it has operated easily at depths below 18,000 feet, and has given no operating problems even in directionally-drilled wells with extreme slant.


Jar-Down Action

▶ **RUN IT IN THE DRILL STRING**—It is specifically designed to withstand the continuous vibration and heavy torque loads of today's drilling operations.

▶ **TO JAR DOWN** whenever the drill pipe threatens to stick—or to drive drill collars out of keyseats and to free "balled-up" bits—simply slack off weight equivalent to about 2,000 feet of drill pipe onto the tool. This releases the tripping mechanism, automatically striking a sharp down blow. Raising the string automatically re-sets the tool for another blow—and blows can be struck repeatedly as fast as the string can be raised and lowered. And no torque or twisting strains are placed in string!


Releasing Action

▶ **TO RELEASE,** in the event jarring will not loosen the stuck string, simply trip the tool and apply reverse torque as the string is slowly raised. Only one-sixth turn of the tool rotates the drive keys into unlocking slots so that complete release is effected by continuing to raise the string.

ANOTHER ADVANTAGE—the tool transmits full torque loads in *either* direction through three rugged drive keys—not through easily-damaged threads. It is the strongest joint in the string—not the weakest, as with conventional safety joints.

Also, the tool can be re-connected again by simply lowering the top portion over the lower portion and reversing the releasing action. It is ideal for use in fishing strings!

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops, Santa Fe Springs and Taft
HOUSTON, TEXAS, 5006 Navigation Blvd. • ODESSA, TEXAS, 1923 West Second Street
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FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 1788
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 837
HOUMA, LOUISIANA, Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y. U.S.A.
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37 years OF OIL TOOL LEADERSHIP

This Lake Maracaibo barge (above) and the Loffland camp at Anaco (right),

as well as its drilling activities in and around Lake Maracaibo.

The problem was more complex in eastern Venezuela, where the company's operations are most scattered. At Anaco, headquarters for eastern Venezuelan operations, Loffland Brothers originally operated a 250-watt main radio station, operating from a 150-foot tower with omnidirectional antenna. The station was in contact with Roblecito, which is 125 miles to the west in central Venezuela, as well as with rigs in the local Anaco area. The Roblecito station was similar, with contacts in its own area.

At Maturin, midway between Anaco and the Gulf of Paria, Loffland

widely separated geographically, are in instant contact with each other by radio.

Brothers has installed a 200-foot tower relay station and a 50-watt set. Those installations automatically connect rigs operating in the Gulf of Paria and rigs in the Maturin area with headquarters at Anaco.

West of Anaco, at Roblecito, a new radio station now affords contact with all rigs in that area and spans the long jump to Anaco. With these new facilities the Anaco headquarters now has direct radio communications with all rigs and stations within a 200-kilometer (125-mile) radius and with mobile automobile units.

The new micro-wave installations are extensions and improvements to the previous radio system and now provide even better communication

For fishing, testing and core-drilling strings . . .

. . . plus Safety Joint protection!

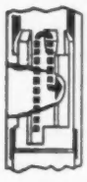
THE SHAFFER OIL-SEALED JAR SAFETY JOINT

The Shaffer Oil-Sealed Jar Safety Joint is the only tool that combines a choice of *jar-up* and *releasing* actions, both under complete control of the operator at all times. What's more, all operating parts are sealed in a chamber filled with clean oil, fully protected against mud, sand and corrosive fluids.

The sealed-in-oil protection not only safeguards against abrasion and corrosion, and minimizes pressure differentials on packing elements, but also insures constant operating characteristics at all depths. This makes the tool ideal for fishing, testing and similar strings where light connections and equipment are used!

Jar-Up Action

JARRING ACTION IS AUTOMATIC—simply raise the drill string until tension equals the pre-set tripping load, whereupon a sharp up blow is struck. Lowering the tool automatically re-sets the tripping mechanism for another blow—and repeated blows can be struck as fast as the string can be raised and lowered.



Releasing Action

ONLY STRAIGHT PULL is necessary to operate the tool—no torque or other secondary operations to affect the light connections commonly used in fishing, testing and coring strings.

TO RELEASE, in the event the fish or stuck string cannot be loosened, simply trip the tool and apply reverse torque as the string is slowly lowered. Only one-sixth turn of the drive keys rotates them into an unlocking slot whereupon raising the string allows the parts to unlock.

AND NOTE THIS—not only does the tool transmit full torque loads in *either* direction, but no threads are used in the releasing mechanism. Therefore there's no risk of torque over-tightening the tool—nor can reverse rotation accidentally release it.

Also, force of the blow is absorbed by integral knocker heads—not by easily damaged drive keys or threads. The tool is designed for *sustained* jarring operations. And since it does not depend upon friction for its tripping action, the Jar Safety Joint always operates with the same pre-set action. Light strings are not subjected to unpredictable loads!

Free 8 page booklet gives many other facts about the Shaffer Oil-Sealed Jar Safety Joint. Write for it—or ask your nearest Shaffer representative.

SHAFFER

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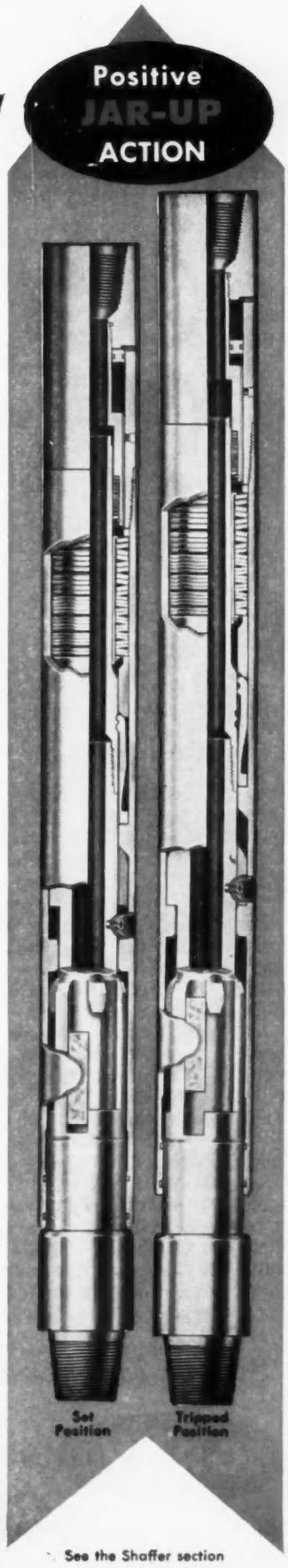
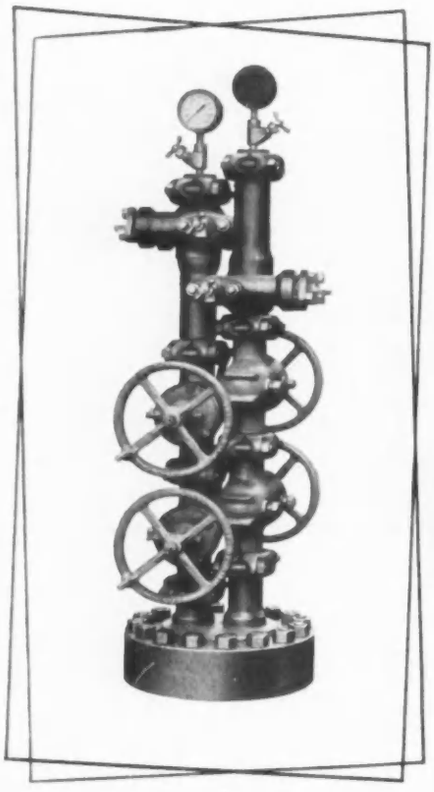
37 years OF OIL TOOL LEADERSHIP



See the Shaffer section of your Composite Catalog.

For more data on advertised products, use Readers' Service Cards, last page.



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Engineered Well Control For Complete Safety

Basic, good engineering design — an extra value built into every Gray Well Control Assembly — demands more strength with less weight, reduction of areas subject to pressure, and elimination of unnecessary parts. An added feature in Gray's Systems is flexibility. Flexibility provides for efficient handling of every well control problem through the application of practical design techniques.

Gray Well Control Systems are engineered to meet the most exacting specification requirements coupled with flexibility. The result is practical, economical well control safety at whatever pay zone you're working — deep or shallow, single or multiple.

For additional information about why engineering makes Gray's Systems best for complete well control, see the Gray Catalog in Composite Catalog or write Gray Tool Company. Remember, Gray gives complete well control for complete safety and . . .

Safety is Economy

GRAY *Tool Company*

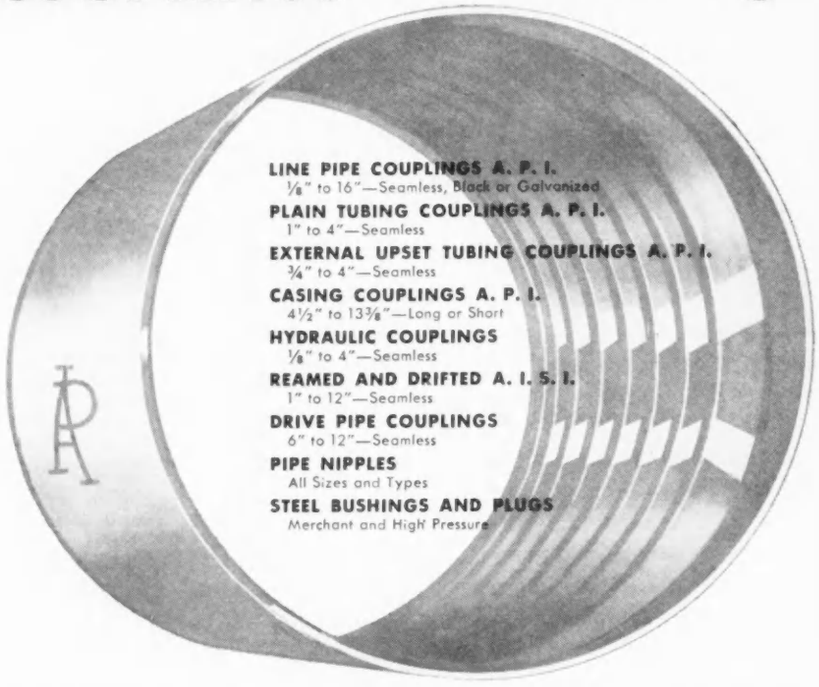
P. O. BOX 2291 HOUSTON, TEXAS
REpublic 4-1641 5906

L. H. Marts, Loffland Brothers Company, talks with a rig in Western Venezuela from the radio at Maracaibo.

between Maracaibo on the west, and Anaco and the Gulf of Paria on the east, a distance of about 700 miles by air. All intermediate points also have radio communications.

In northwest Venezuela the radio system around Lake Maracaibo is somewhat more extensive, although it covers less over-all area. The lake itself is about the size of the state of

COUPLINGS BY Wheeling


LINE PIPE COUPLINGS A. P. I.
⅛" to 16"—Seamless, Black or Galvanized
PLAIN TUBING COUPLINGS A. P. I.
1" to 4"—Seamless
EXTERNAL UPSET TUBING COUPLINGS A. P. I.
¾" to 4"—Seamless
CASING COUPLINGS A. P. I.
4½" to 13⅜"—Long or Short
HYDRAULIC COUPLINGS
⅛" to 4"—Seamless
REAMED AND DRIFTED A. I. S. I.
1" to 12"—Seamless
DRIVE PIPE COUPLINGS
6" to 12"—Seamless
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All Sizes and Types
STEEL BUSHINGS AND PLUGS
Merchant and High Pressure

WHEELING MACHINE PRODUCTS CO.

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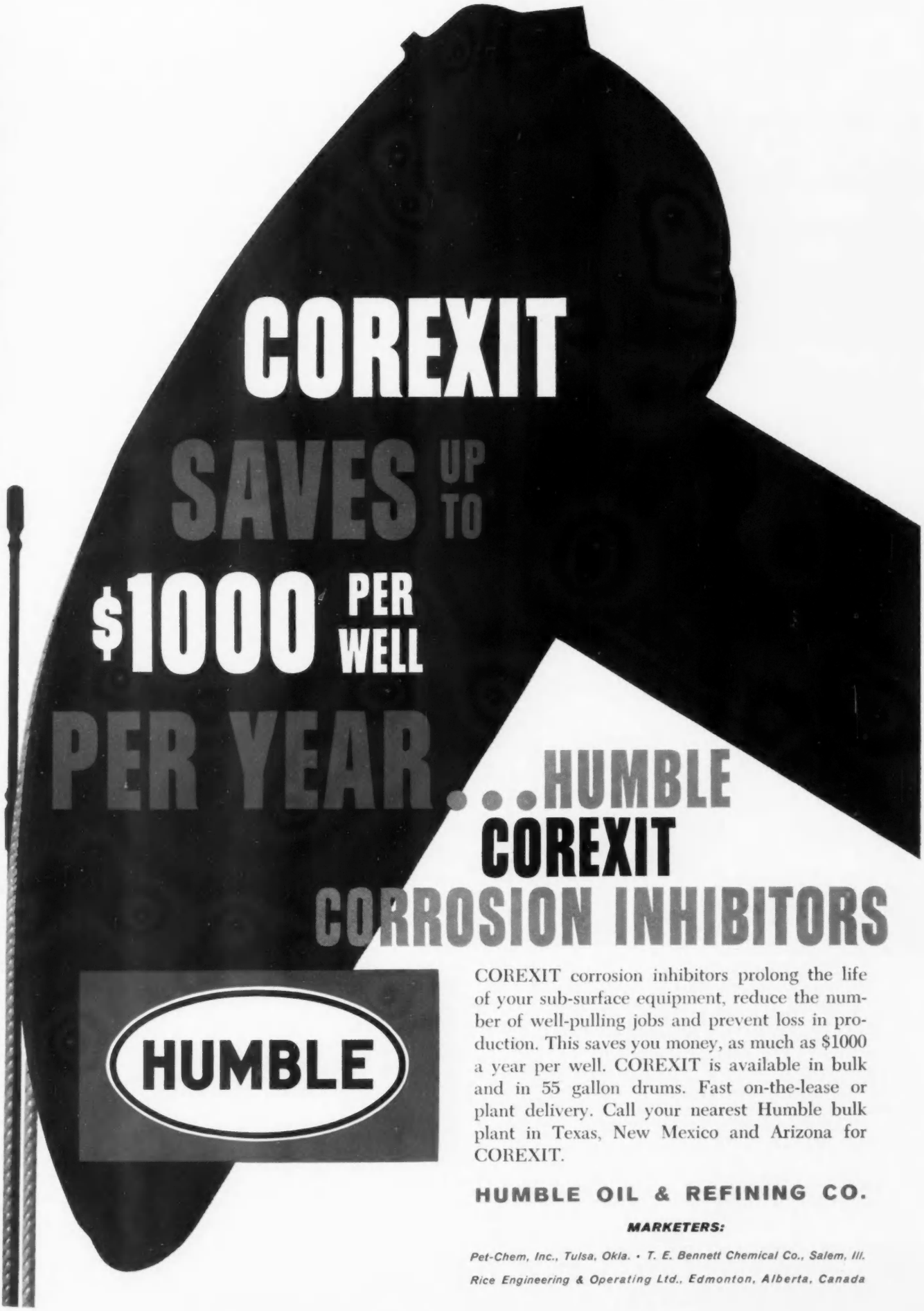

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COREXIT corrosion inhibitors prolong the life of your sub-surface equipment, reduce the number of well-pulling jobs and prevent loss in production. This saves you money, as much as $1000 a year per well. COREXIT is available in bulk and in 55 gallon drums. Fast on-the-lease or plant delivery. Call your nearest Humble bulk plant in Texas, New Mexico and Arizona for COREXIT.

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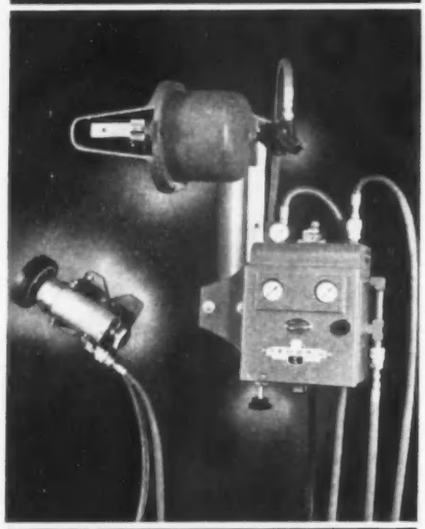
The NEW GEODRIL® AUTOMATIC DRILLER



gives you

1. LONGER BIT LIFE
2. FEWER TRIPS
3. STRAIGHTER HOLE

The GEODRIL Automatic Drilling Control was developed, tested and proved in the field by The Geograph Company, manufacturers of the internationally accepted Geograph Mechanical Well Logging Recorder.

The new, automatic GEODRIL control has many outstanding features and offers the drilling contractor dependability, economy and safety.

Service for the GEODRIL Control is provided by the experienced personnel of Geograph Oil Field Services. Their reputation for service is backed by over a fifth-of-a-century of experience in the oil fields.

When you drill your next well, specify the NEW GEODRIL Automatic Driller for maximum drilling efficiency. For additional information, contact your nearby Geograph Oil Field Services office.

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Massachusetts. The station is at the Kilometer Nine yard, just a few miles south of Maracaibo, and is connected with the headquarters office by a relay.

Loffland Brothers Company's 19 motor launches and 6 drilling tender barges operating in Lake Maracaibo are all radio equipped. Las Morochos and San Timoteo camps, on the east coast of the lake, have stations plus mobile sets in automobiles. The entire system operates on a 24-hour basis.

To insure continuous radio operations between rigs and drilling offices, radios on operating rigs remain in contact with their drilling offices around the clock. To increase the radio efficiency even further, a bell system has been installed. The bell system allows drilling offices to contact individual rigs by simply pressing a button which activates a bell system on the rig or barge. The ringing can be heard over the entire drilling location or barge. This system permits toolpushers to be anywhere on the location or barge, and yet be conveniently called to the radio.

Loffland Brothers Company's operations in Colombia are on a smaller scale, and the radio setup is also smaller. However, from its Cartegena headquarters, supervisors are in constant contact with rigs by radio. Distances to rigs range up to 380 kilometers (236 miles). —The End

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Your industry at work

A monthly roundup of items of interest about people, companies and associations

National Petroleum Council To Hold March Meeting

Walter S. Hallanan, chairman of the National Petroleum Council, has called a meeting of the Council for Tuesday, March 22, at 9:30 a.m., to be held in Conference Rooms A and B of the Department Auditorium, located between Twelfth and Fourteenth Streets on Constitution Avenue, N.W., Washington, D.C.

Chairman Hallanan has noted that this will be an organizational meeting and the first regular meeting of the 1960 Council. He also noted that final reports from the Committee on the Use of Radio and Radar (1959) and the Committee on Petroleum Storage Facilities (1959) were expected to be ready for Council consideration at the meeting. In addition, Hallanan anticipates that progress reports by the Committee on Petroleum Refinery Maintenance and Chemical Requirements and the Committee on Petroleum Reserves will be submitted.

Personal attendance of all Council members is urged by Hallanan.

Officials of YPF Hear Clark On Secondary Recovery

More than 100 officials of Yacimientos Petroliferos Fiscales, the Argentine national oil company, recently heard the potential of secondary recovery in their country outlined by Norman J. Clark, of Dallas, an international independent secondary recovery authority.

Clark was presented to the special YPF gathering by W. H. Davison, president of Tekoil Corporation, a Dallas oil company which specializes in secondary recovery. Davison is in Buenos Aires investigating the feasability of Tekoil's beginning secondary recovery projects in Argentina.

In addition to top management, directors and technical personnel of YPF, a selected group of representatives from American oil companies, local banks and businesses heard Clark explain the role secondary recovery could play in Argentine oil production.

Clark recently returned from Europe where he went at the invitation of the Italian and Austrian governments to consult on oil problems.

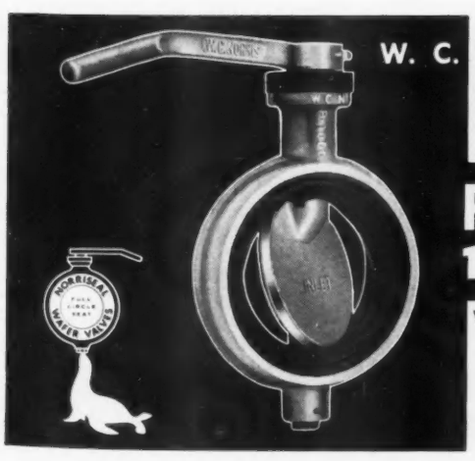
American Climax Properties Transferred to Blackwell Zinc

American Climax Petroleum Corporation recently transferred all its properties and operations in Oklahoma and in certain operations in other areas to Blackwell Zinc Company, Inc. The action took place following a management decision made late in 1959. Both American Climax Petroleum Corporation and Blackwell Zinc Company, Inc., are wholly owned subsidiaries of American Metal Climax, Inc.

All properties which were operated by the Tulsa Division of American Climax Petroleum Corporation are now operated by Blackwell Zinc Company, Inc., Oil

World's First Airborne Gradiometer Records Earth's Gravity

John B. McClusky, marketing engineer with Lundberg Explorations, of Toronto, receives at Calgary records made of changes in the earth's gravity in the mineral-rich PreCambrian Shield and across the sedimentary basin of Western Canada to the Rockies. The profile was made by the company's airborne gradiometer, the world's first, which was unveiled recently at the first International Symposium of Arctic Geology in Calgary. Holding the instrument is Wally Hobbs, chief company electronic technician. Handing over the records is Lloyd Reach, chief of the company's laboratory where the instrument was developed. Responsible for introducing successfully the Canadian-designed airborne electromagnetometer and other survey techniques to world-wide use, McClusky is now assigned to explain the applications of the instrument to geologists around the world on demonstration tours.



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Your industry at work

Division. The new arrangements became effective January 1. This includes the Nowata and Southern Oklahoma districts, Leeco and Oil Springs, Ky., districts and Coleman, Texas, districts. The announcement also stated that there would be no changes in either the personnel or polices presently employed in connection with the oil operations and that all mailing addresses will remain unchanged.

Shell Companies Foundation Will Donate Over $1 Million

Shell Companies Foundation, Incorporated, has announced that it will contribute $1,430,000, in 1960 to educational charitable, religious and public service organizations. Last year, donations were reported to have amounted to $1,162,645.

The 1960 budget marks the sixth successive year that the Foundation budget has exceeded a million dollars. Donations are made possible by substantial gifts made to the Foundation by Shell Oil Company and its operating subsidiary companies.

Pure Reorganizing Operations Of Exploration and Production

The Pure Oil Company has announced that it is taking steps to reorganize the field operations of its exploration and production division.

According to the announcement, about July 1, Pure's Rocky Mountain producing division with headquarters in Denver, its Southwestern division in Tulsa and its Eastern division in Olney, Ill., will be consolidated to form the Northern producing division with headquarters in Denver. About September 1, its Texas producing division in Fort Worth and Gulf Coast division in Houston, will be consolidated to form the Southern producing division with headquarters in Houston.

As a result of the action, Pure Oil will materially enlarge its Denver and Houston staffs and close its offices in Tulsa and Fort Worth. The company plans to maintain a producing office in Olney.

Louisiana Contractors Form Continental Rigs, Incorporated

Three New Orleans drilling contractors, who operate six inland barge rigs in South Louisiana, have consolidated their operation in a unique method of operation which has never been tried before in the industry.

The new agency corporation is Continental Rigs, Inc. The member companies joining forces in the venture are: Continental Drilling Co., Inc., with one rig, of which M. A. Smith, Jr., is president; M. A. Smith Drilling Corporation, with three rigs, of which M. A. Smith, Sr., is president; Continental Shelf Drilling Corporation, with two rigs, of which Joseph M. Rault, Jr., is president.

The member companies have established a system, based on total revenue

a Baroid Mud Program

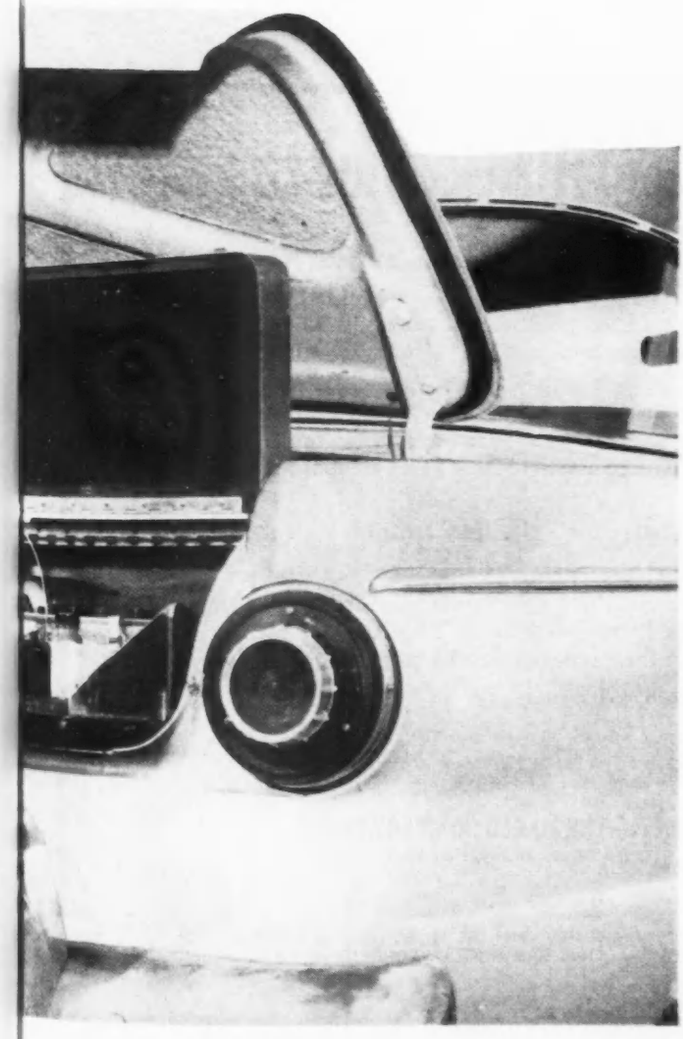
MUD PROBLEM

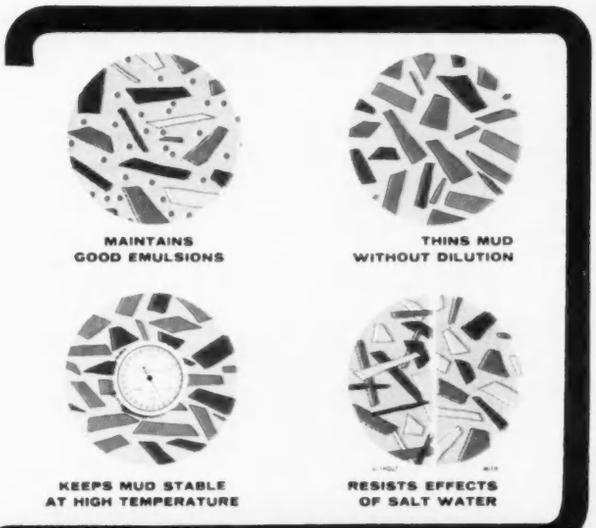
... and its solution

This case history shows how a complete Baroid mud program gives you successful mud control under the most adverse conditions. In this instance problems included depth to 16,684 feet, bottom hole temperatures up to 356°F, mud weight up to 19.1 lb/gal, salt contamination and lost circulation.

Baroid engineered services and products, coordinated with a pilot-tested program, enabled operating crews to maintain a lime-treated oil emulsion mud that was always as thin as needed . . . that did not gel excessively at high temperature . . . that had low filtrate loss . . . and that cut mud costs by 25%.

Baroid's improved new concept of modern marketing methods gives you an integrated mud service assuring quality control of products, engineering accuracy and technical ability that combine to save *your* drilling dollars.





BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

6007

and total expenditure of each company, for prorating costs. A merger was not effected mainly because their operations were too closely tied together and because all member companies wanted to keep their separate identity. This arrangement would also permit other contactors who wish to operate on this basis in this new venture coming in without any change in their corporate set-up.

Standard of Indiana Consolidates Departments

Standard Oil Company (Indiana) has completed consolidation of all research on petroleum products and processes, as well as for two subsidiaries, into a single Research and Development Department. The consolidation became effective January 1.

The new department, a part of the parent company, is now responsible for product and process research requirements of affiliated American Oil Company and Utah Oil Refining Company as well as of Standard.

The research reorganization for the parent company will also include the transfer of manufacturing technical service from the Research and Development Department to the Manufacturing Department, and the transfer of engineering research from manufacturing to the new Research Department.

Men in the industry

Legh-Jones

F. N. Haden

P. E. L. Legh-Jones has been named manager of **Shell Oil Company of Canada's** newly formed Area Services Department in Calgary, and **F. N. Haden,** administrative assistant in Calgary, has left Shell of Canada to work in the Employe Communications Department of **Shell Oil Company** in New York.

Roy E. Dosser, division manager at Jackson, Miss., and **H. C. Calhoun,** division exploration superintendent, have been appointed to general staff posts in Tulsa for **Sinclair Oil & Gas Company.**

J. P. O'Conner, formerly district geologist at Tyler, Texas, for **Tidewater Oil Company,** has been promoted to assistant division geologist and transferred to Tidewater's Houston headquarters. **George G. Wise,** previously district exploitation geologist in Lafayette, La., replaces O'Conner at Tyler. **Harry L. Frank,** Houston geologist, was promoted to district exploitation geologist at Lafayette.

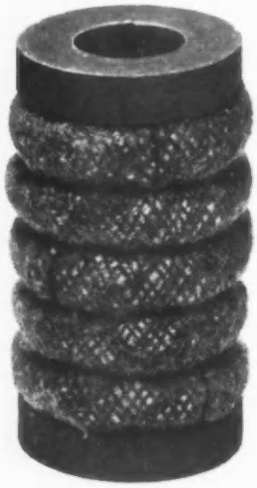
J. D. Nitzschke has been appointed assistant manager of **American Oil Company's** Terminal Department. Nitzschke is succeeded at Providence, R. I., by **M. Hanewich,** assistant superintendent.

G. D. (Dan) Almen, Jr., has been elected a vice president of **Sinclair Oil Corporation.**

Dr. George H. Fancher, petroleum engineering professor and research engineer for 24 years at The **University of Texas,** has been named vice president in charge of the **Sinclair Research Laboratories, Inc.,** in Tulsa. Fancher will direct an enlarged research program by Sinclair aimed at broadening the company's search for new methods of finding and recovering crude oil.

Dr. G. H. Fancher

MARLO PACKING CUTS EVERYTHING...but the ROD!



RW—6E Sets for Round Stuffing Boxes

MARLO POLISHED ROD PACKING cuts packing budgets, cuts oil losses, cuts rod wear, cuts labor waste, cuts downtime, cuts aggravation.

Years of field use by leading producers, mounting sales in every area, prove that MARLO outlasts ordinary packings up to 10 times and more. WHY? Because the anti-frictional, corrosion-resistant, semi-metallic rings form a smooth, super-dense, shock-absorbing, resilient, bearing-like surface, which stands up to punishment, survives longer, and will not harden or burn during pump-off. **Available in all standard sizes.**

MARLO IMPROVED PACKINGS FOR HERCULES AND RATIGAN STUFFING BOXES

Vitalizing, anti-frictional, semi-metallic inserts both metallize the contact surface and absorb lubrication, thereby vastly extending packing life under the toughest operating conditions. This unique feature, with its inherent, engineered performance, cannot be found in any all-rubber packing, whatever design is attempted.

Available through any supply store you deal with.

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Men in the industry

Lewis Finch, Jr., has been appointed manager of production for **Pan American Petroleum Corporation** at the firm's general office in Tulsa. Finch, formerly chief engineer, Producing Department, will be in charge of coordinating Pan American's diverse production activities on the North American continent. He also has been elected a director of **Pan American Gas Company.**

Lewis Finch, Jr.

R. P. Ryan has been named general counsel and a director of **The Carter Oil Company.**

Curtis Stevens and **Kenneth Chasteen** have dissolved the partnership and management of the *Panhandle Oil Explorer*, turned to *Dwight's Oil and Gas Reports* of Amarillo. Chasteen remains with the *Explorer* as managing editor. Stevens continues his present position as editor and publisher of the *National Petroleum Bibliography.*

E. O. Buck, senior vice president of **The National Bank of Commerce,** Houston, and head of the Bank's Oil and Gas Loan Department, has been appointed to the **National Petroleum Council** by the **United States Secretary of the Interior, Fred A. Seaton.** Buck is only the second Council appointment drawn from a banking field since formation of the organization in 1946.

Arthur A. Curtice has resigned as president and general manager of **Signal Oil and Gas of Venezuela** to resume work as a private petroleum consultant.

F. R. Hall

Franklin R. Hall has been elected president and a member of the board of directors of **Esso Standard Oil Company (Uruguay) S.A.** Hall has been manager of the Southern Division of Esso do Brazil for the past three and one-half years. In his new position, Hall replaces the late **Willim B. Brown.**

N. M. Ekserdjian, N. Y. Ruth and **L. R. Murphy** have been appointed executive directors of **The Iraq, Basrah and Mosul Petroleum companies.**

Charles R. Yarbrough has been named natural gas manager for the Exploration and Producing Department of **Mobil Oil Company.** He will transfer to the New York headquarters from **Mobil Oil of** Canada, Ltd.

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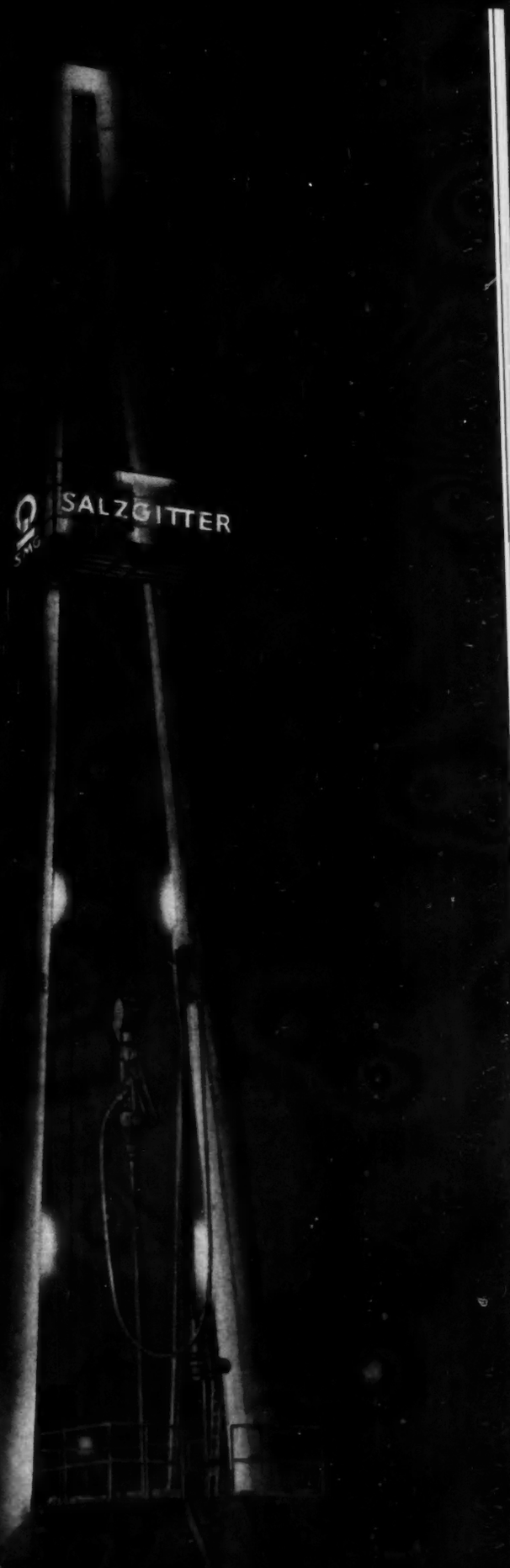
Full view Salzgitter Masts are in operation in Europe and overseas on numerous oilfields.



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Men in the industry

V. J. Malloy has been named the new district landman for **Tidewater Oil Company's** Corpus Christi, Texas, office. Malloy, formerly district landman at Durango, Colo., has been replaced there by **Peter P. Groth,** formerly in Tidewater's New Orleans office. **W. C. Shead,** statistician in the Houston office, has been promoted to landman and transferred to New Orleans replacing Groth. **James K. Morrison, senior clerk,** has been promoted to satistician in the Houston headquarters.

John R. Penn, Jr., Fort Worth investor, has been named to the board of directors of **Texas Pacific Coal and Oil Company.**

J. R. Learned

James R. Learned, former manager of land and exploration for Husky Oil Company, has recently opened offices in Cheyenne, Wyo., as an independent petroleum consultant and attorney at law. In 1957 and 1958, Learned served as vice president of Argus Petroleum Corporation, a Husky subsidiary operating in Guatemala.

Hadley H. Myers, personnel representative in charge of safety and training, has been named manager of the new Safety Department recently formed by **Sinclair Oil & Gas Company,** Tulsa. **John D. Sullivan,** personnel representative, was appointed manager of the Personnel Department.

Stuart P. King, senior vice president of **Tennessee Argentina, S.A.,** a wholly-owned subsidiary of **Tennessee Gas Transmission Company,** Houston, has assumed managership of the company's Argentine operations. **Marshall A. Jeffers,** vice president of Tennessee Argentina, has been assigned as production manager for Argentine operations.

Fred Stephens has acquired sole ownership of the firm **Cable & Stephens, Petroleum Engineers,** Wichita Falls, Texas, having purchased the partnership interest of **Jo H. Cable.** The firm name will be **Stephens Engineering.**

William R. Low, landman at Corpus Christi, has been transferred to Lafayette, La., and **James D. Wiley,** scout at Midland, Texas, for **Tidewater Oil Company,** has been moved to Oklahoma City.

Shell Honors 'Long Timer'

This isn't William (Bill) Shepherd's real five-diamond, 45-year Shell Oil Company service award pin—it's just a mock-up of the real pin presented him moments earlier by S. F. Bowlby (right), Shell's Pacific Coast Area vice president. The "enlarged" award was "something extra" to emphasize that Shepherd is the senior Shell employe in the United States. Shepherd is auditor of disbursements in the company's Pacific Coast Treasury Department.

Arthur H. Denny has been named Canadian division gas superintendent by **Pan American Petroleum Corporation.** Denny moves to Calgary from Powell, Wyo.

Christian R. Holmes of San Francisco and San Antonio, and **Kenneth P. Dillon** of Reno, Nev., have been named vice president and secretary-treasurer, respectively, of **North Star Oil Company** by the board of directors. **Lionel Steinberg** of Palm Springs, Calif., joins **Leroy Hines,** San Francisco; **Cornelius Cole II,** Beverly Hills, Calif., **William L. Dugger,** San Antonio; **Hoagy Carmichael, Holmes** and **William Moss,** president, on the board of directors.

OILFIELD TRUCK AND FLOAT

Thornycroft Sandmaster 252" wheel base Oilfield Truck. Hands-England full Oilfield Body. 60,000 lb. winch, heavy duty gin poles, winch operated gin pile risers and folding SAE king pin.
Hands-England 75,000 lb. capacity, tandem axle Oilfield Float 30' 0" long and 9' 6" wide, folding support legs and inverted 36" fifth wheel.
Truck and Float on Michelin 18.00 x 25. Sahara sand tires.

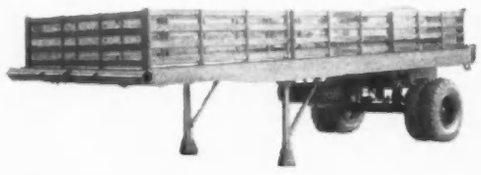
OILFIELD TRANSPORTATION EQUIPMENT

OILFIELD FLOAT

Hands-England 75,000 lb. capacity tandem axle Oilfield Float 30' 0" long and 8' 6" wide, folding support legs and inverted 36" fifth wheel.
Truck and Float on 11.00 x 20 – 14-ply tires.

OILFIELD TRUCK AND FLOAT

Scammel Constructor 261" wheel base Oilfield Truck.
Hands-England 75,000 lb. capacity tandem axle Oilfield Float 30' 0" long and 9' 6" wide, folding support legs and inverted 36" fifth wheel.
Truck and Float on 14.00 x 20 – 18-ply tires.



OILFIELD FLOAT

Hands-England 25,000 lb. capacity single axle Oilfield Float 24' 0" long and 8' 0" wide, folding support legs and SAE king pin 11.00 x 20–12-ply tires. Steel stake sides.

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Men in the industry

L. E. Cotulla has become a consultant to **Phillips Petroleum Company,** working largely on research on international operations.

Ray Butler has been named a vice president of **Harkins & Company,** South Texas producing and drilling contracting firm with offices in Alice, Texas. Butler will be in charge of company wide operations. Other department heads include **A. G. Holzapfel,** landman; **Roy I. Jindra,** chief geologist; **W. T. Steen,** superintendent, and **E. C. Clark,** chief accountant.

B. C. Barnes

R. R. Click

Brunner C. Barnes and **Robert R. Click** have announced the formation of **Barnes & Click,** an engineering firm specializing in consultation and design work related to natural gas production and processing. Their offices are in the **Rio Grande National Building,** Dallas.

William Harvey Skipwith, Jr., has been elected a director of **Bradco Oil & Gas Company** and **Bradco Associates, Inc.** He will serve both companies as vice president and secretary.

Garth L. Young has been named president and **R. C. Vlack** has been appointed resident manager of **Signal Oil and Gas of Venezuela.**

John A. Redding has been promoted to second vice president in the utilities and oil division of **Continental Illinois National Bank and Trust Company of Chicago.**

A. Martin Eichelberger, marketing executive and petroleum exploration authority, has joined **Dibrell and Company, Inc.,** a Philadelphia-based firm of management consultants, as a participating partner and executive vice president in charge of market development.

Dr. Virgil J. Berry, Jr., formerly with Pan American Petroleum Corporation, Tulsa, has joined **Sinclair Research Laboratories, Inc.,** as director of the petroleum engineering research division. **Dr. Stephen E. Szasz,** technical director for Sinclair's petroleum engineering research, was promoted to departmental research associate.

K. W. Sims has been appointed export promotion manager of **C. C. Wakefield & Company Limited,** parent company of the **Castrol Oil Group.** Sims joined the company in 1951. In 1954 transferred to the Overseas Division and posted to Cyprus as resident manager, Middle East. In 1957 he returned to headquarters and was attached to the Group's American subsidiary, **Castrol Oil Incorporated** until his most recent appointment.

K. W. Sims

J. T. Cawley, Saskatchewan mining engineer, has been appointed petroleum exploitation adviser on the **United Nations Technical Assistance Mission to Burma,** Cawley is the provincial deputy minister of mineral resources.

John F. Harris, Tulsa, has resigned from Pan American Oil Corporation to become an independent geological consultant with temporary offices in Tulsa.

Don F. Carlos of Houston has been appointed executive assistant to **Thomas G. Kelliher,** manager of **Tidewater Oil Company's** home office Exploration Department in Los Angeles.

C. D. Owens, Jr., manager of industrial relations for **Sinclair Oil & Gas Com-**

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Men in the industry

pany, Tulsa, has been transferred to New York City as assistant to **Millard E. Stone,** vice president and director of industrial relations for the Sinclair companies.

W. C. Smith and **Fred P. Sewell** have been elected senior vice presidents, new positions, in the **Delhi-Taylor Oil Corporation.** Formerly vice presidents in charge of specific operations, they both will have broader areas of responsibility.

Dean Walling, president of **Western Geophysical Company,** has been chosen "Alumnus of the Year" from among 20,000 former students of Abilene Christian College, Abilene, Texas. Walling is a vice president of the International Society of Exploration Geophysicists and a past president of the Pacific Section, SEG.

Roger A. Harris, Tyler, Texas, has been elected assistant vice president of the **Republic National Bank of Dallas.** Prior to his election at Republic National Bank, Harris had served as a vice president of the People National Bank of Tyler.

Robert L. Minckler, senior vice president of the **Mobil Oil Company,** has announced his plans to retire from service with the company about the middle of the year. Minckler was president of General Petroleum Corporation from 1948, until it was merged into its parent company January 1, 1960.

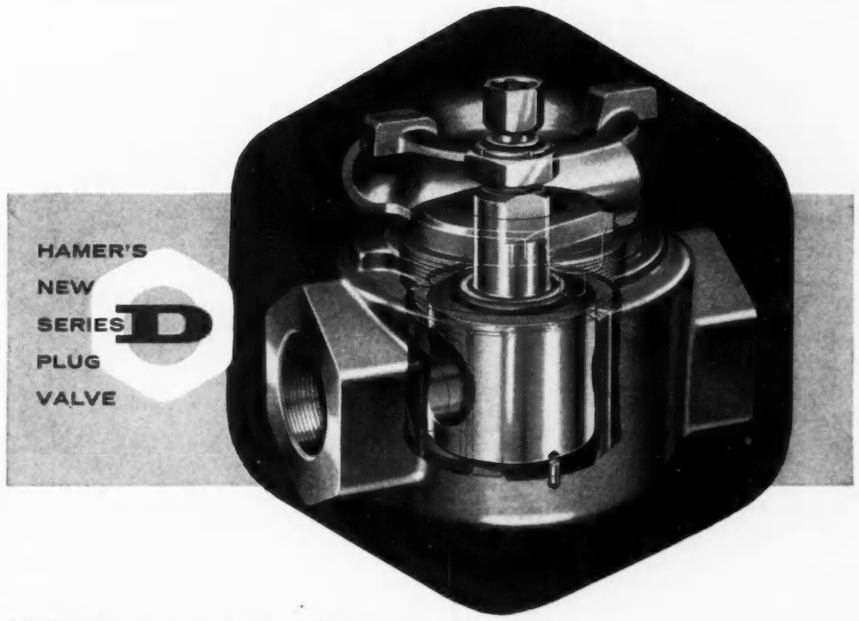
R. L. Minckler

Howard Kiatta has been promoted to assistant to division manager, Denver Division of the Domestic Producing Department of **Texaco Inc.,** and **Jack E. Robbins** has been advanced to division landman, succeeding Kiatta.

J. W. Hood, former supervisor of community relations at **The Ohio Oil Company,** has been appointed manager of the newly created Public Relations Activities Department.

Claude B. Barrett, senior vice president and chief executive officer at Houston for **Texaco Inc.,** and a member of the board of directors, has been elected chairman of the board of **Houston Federal Savings & Loan Association.**

Ben H. Wooten, president of **First National Bank** in Dallas since 1950, has been elected active chairman of the board. **John J. Kettle,** senior vice president and veteran of 47 years of service with the bank, was named active vice chairman and **Robert H. Stewart III,** senior vice president, was advanced to president and chief executive officer.



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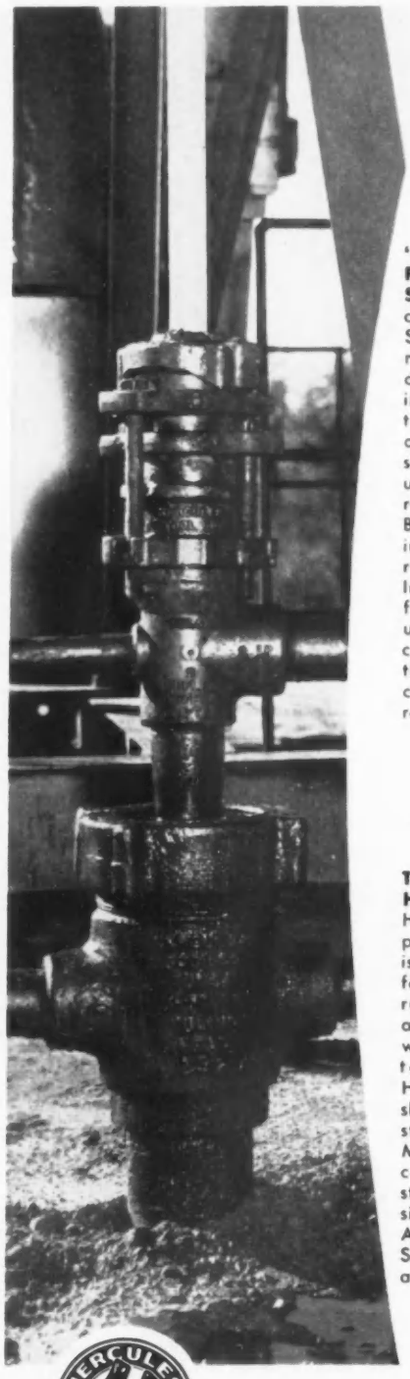

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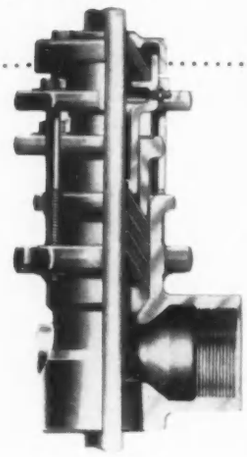
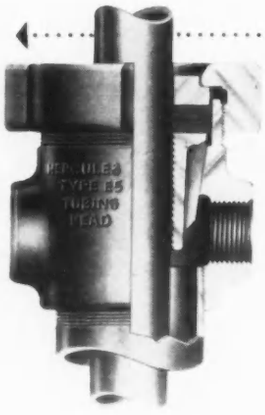


TYPE "E5" TUBING HEAD—This Tubing Head is ideal for any pumping situation. It is economical enough for shallow wells and rugged enough for any depth well, with working pressure up to 1500 pounds. Hercules self-aligning slips suspend the inner string in this Head. Mandrel suspension can be furnished instead of slips, if desired, at no extra cost. A neoprene Tubing Stripper Unit is also available.



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WHO'S MEETING WHERE

Mar. 2– 4	API, Division of Production, Southwestern District Meeting, Statler-Hilton Hotel, Dallas.
7	Canadian Petroleum Association, Annual General Meeting, Palliser Hotel, Calgary, Alta.
10	PESA, Northern Mid-Continent District, Mayo Hotel, Tulsa.
14–18	NACE, 16th Annual Meeting, Memorial Auditorium, Dallas.
16	PESA, Eastern District, Duquesne Club, Pittsburgh.
16–18	API, Division of Production, Southern District Meeting, Hilton Hotel, San Antonio, Texas.
18–	Upper Gulf Coast Drilling & Production Conference, Beaumont, Texas.
21– to April –29	The University of Texas, School of Gas Technology, Sixth Semi-Annual Term, Kilgore College, Kilgore, Texas.
23	Oil Trade Association of New York Meeting, Waldorf-Astoria Hotel, New York City.
23	PESA, Pacific District, Ambassador Hotel, Los Angeles.
28– to May 6	The University of Texas and API Division of Transportation, School of Pipe Line Technology, Eighth Semi-Annual Term, Lee College, Baytown, Texas.
24–25	Petroleum Conference on Reservoir & Production Engineering, Tulsa.
25–26	Thirtieth Annual Meeting of North Texas Oil & Gas Association, Kemp Hotel, Wichita Falls, Texas.
28– to May 6	The University of Texas and API Division of Production, First Term of the Institute on Automatic Controls, Odessa College, Odessa, Texas.
29	PESA, Gulf Coast District, Shamrock Hilton Hotel, Houston.
30 thru Apr. 1	API, Division of Production, Mid-Continent District Meeting, Broadview Hotel, Wichita, Kan.
April 5	PESA, Southern Mid-Continent District, Statler-Hilton Hotel, Dallas.
5– 6	Eighth Annual Gas Compressor Institute, National Guard Armory, Liberal, Kan.
7– 8	Rocky Mountain Oil & Gas Association Mid-Year Meeting, Newhouse Hotel, Salt Lake City, Utah.
12–14	Thirty-second PIEA-PESA Conference and Exhibition, Municipal Auditorium, Kansas City, Mo.
14	Annual Business Meeting and Technical Session of the Permian Basin of the SEPM, Windsor Hotel, Abilene, Texas.
15–16	Annual Field Trip of the Permian Basin of the SEPM, Windsor Hotel, Abilene, Texas.
20–22	API, Division of Production, Rocky Mountain District Meeting, Gladstone, Henning and Townsend Hotels, Casper, Wyo.
20–22	NPA, Semi-annual Meeting, Hotel Cleveland, Cleveland.
21–22	Seventh Annual West Texas Oil Lifting Short Course, Texas Technological College, Lubbock.
21–22	West Texas Lifting Short Course, Seventh Annual Short Course, Texas Tech College, Lubbock, Texas.
21–23	Permian Basin Section SEPM, Annual Meeting and Field Trip, Abilene, Texas.
24–26	IPA of America, Mid-Year Meeting, Denver-Hilton Hotel, Denver.
25–28	AAPG-SEPM, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N.J.
25– thru May 6	Advanced Drilling Engineering Course, Texas A. & M. College, College Station, Texas.
28–30	AIME, Pacific Northwest Regional Conference, Sheraton Hotel, Portland, Ore.

Nomads' Chapter monthly meeting: Los Angeles, second Wednesday, Hotel Biltmore, Wallace A. Sawdon, Secretary. Houston, second Monday, Ye Old College Inn, Harry E. Estes, Secretary. Dallas-Fort Worth, first Monday, Greater Dallas Club, Hank Davis, Secretary. Tulsa, Hotel Tulsa, Gilbert Swift, Secretary. New York, first Monday, Hotel Biltmore, Jesse E. Hickman, Secretary.

Associations

New York NOMADS Elect 1960 Officers

Hollis W. Haltom, Beckley, Haltom & Hickman, has been elected 1960 president of the New York Chapter of NOMADS. Other officers are (seated left to right): John D. Evans, Lucey Export Corporation, secretary; W. E. Volkman, Cardwell Manufacturing Company, vice president; Haltom; D. T. O'Connor, D. T. O'Connor, treasurer, and R. L. Faris, Mission Manufacturing Company, sergeant-at-arms; (Standing left to right) T. E. Ramsey, Continental-Emsco Company, assistant treasurer; Maurice F. Delano, Jr., R. S. Stokvis & Sons, Inc., senior regent; Don E. Kircher, Gardner-Denver Company, regent; John Davis, Mid-Continent Supply Company, assistant secretary; Paul Nagle, Andreason-Lundberg Corporation, and E. T. Landgraff, Chiksan Export Company, assistant sergeant-at-arms.

Denver Landmen Elect R. A. Follansbee President

Robert A. Follansbee has been elected president of the Denver Landmen's Association for 1960.

Vice presidents include William J. Conroy, Gerald Eckley, Joe Mills, Ed Skeeters and Marion Wall.

Cliff Langley Elected President of High Plains

Cliff Langley, with Gulf Oil Corporation, Liberal, Kan., has been elected president of the High Plains Oil Scouts Association for 1960.

Other officers include D. L. Fahrney, Phillips Petroleum Company, Amarillo, Texas, vice president; Fran Hansen, Cities Service Oil Company, Liberal, secretary-treasurer. Past president is J. L. Young, Shamrock Oil and Gas Corporation, Amarillo.

The High Plains check covers western Kansas, southeastern Colorado and the Oklahoma and Texas Panhandles.

Guests of Houston NOMADS

Guests at the February meeting of the Houston Chapter of NOMADS were: (left to right, standing) Hugo Drago, engineer, Cosmana-Pero, Pettit Throaks, Peru; L. L. Durkin, sales representative, Chiksan, International, Paris, France; George H. Weber, editor, The Oil and Gas Journal, Tulsa, the principal speaker; Stanley Kessenger, Maracaibo, Venezuela; A. Wilmering, Bataafe, I.P.M., The Hague. (Seated, left to right) D. D. Lewis, Import Tool Company, Ltd., Calgary; R. E. Roberts, Lummus Company, Santa Barbara, Chile; Stan Bliss, Sterling Packing and Gasket Company, Maracaibo.

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for a good cement job

B and W Latch-On Centralizer mounted over B and W Automatic Stop Collar

Gets casing to bottom
Prevents channeling
Centers casing positively

B and W Inc.
Well Completion Specialists

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Houston 12, Texas
PHONE WAlnut 3-6603

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19706 South Normandie Ave.
Torrance, California
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148

For more data on advertised products, use Readers' Service Cards, last page.

Associations

Oil Information Committee Honors Nine Members

The oil and gas industry honored nine of its members recently for "outstanding performance" in its public information and service program. Individual awards were presented during the annual meeting of the Oil Information Committee of the Texas Mid-Continent Oil & Gas Association by Regional Vice Chairman Hamilton Rogers of Fort Worth, vice president of T & P Coal & Oil Company.

Recipients of OIC's highest award were Sid W. Binion, general manager of crude oil purchases and sales for the McWoods Corp., Abilene; Frank Darden, manager of operations, Newmont Oil Co., Fort Worth; Joe M. McLaughlin, division production manager, Mobil Oil Co., Lubbock; Roy Minear, vice president J. P. (Bum) Gibbens, Inc., Midland; David Newby, R. S. Anderson, Inc., Post; Eleanor Whaley, executive secretary, TXL Oil Corp., Dallas; and from Houston, Val Jean McCoy, division public relations director, Shell Oil Co., Patricia Jean Gallagher, secretary, Humble Oil & Refining Co., and Walter E. Belt, Jr., division landman, Texas Eastern Transmission Corp.

Awardees were cited for specialized work in communities and schools in the OIC program during 1959.

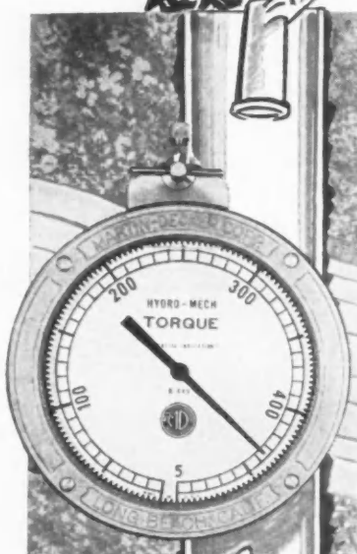
FOR THAT

"Down-Hole Vision"

Specify **Martin-Decker**

HYDRO-MECH ROTARY TORQUE

And Get The Fish Every Time!



FISHING – MILLING – CORING

All these jobs need every bit of information possible to get them done quickly and correctly. The weight indicator is a lot of help but weight and torque give you complete "Down-Hole Vision".

- **A rugged instrument of remarkable sensitivity**
- **Indicates locked cones and out of gauge hole**
- **Excellent indication of hole condition**
- **Installed under any rotary or drawworks chain**
- **Stabilizes chain and gives it longer life**
- **Minimizes danger of twist-offs**
- **Increases footage when drilling with small bits**

The Martin-Decker Hydro-Mech Is An Indispensable Aid For Drilling–Controlled Reaming –Fishing–Milling–and Diamond Coring.

Write for Descriptive Literature

MARTIN-DECKER CORP.

HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

F. B. Conselman

G. V. Cohee

Ben H. Parker Elected President of AAPG

Ben H. Parker, vice president and director of the Frontier Refining Company, Denver, will become the new president of the American Association of Petroleum Geologists on April 28. Parker will become the association's forty-fourth president.

B. H. Parker

Serving with Parker on the 1960-61 executive committee of the world's largest geological organization will be Lewis G. Weeks, consulting geologist, Westport, Conn., as past-president; Frank B. Conselman, consulting geologist, Abilene, Texas, as vice president; George V. Cohee, U.S. Geological Survey, Washington, D.C., as secretary-treasurer, and Grover E. Murray, Boyd professor of geology at Louisiana State University, Baton Rouge, the present editor.

The new slate of AAPG officers will assume the responsibility of directing the 15,000 member organization at the close of the forty-fifth annual meeting of the Association which will be held at the Chalfonte-Hadden Hall Hotel, Atlantic City, N.J., April 25-28.

Retiring members of the present AAPG Executive Committee are Geo. S. Buchanan, Husky Oil Company, Cody, Wyo., past president; Alfred H. Bell, Illinois Geological Survey, Urbana, vice president, and Harold T. Morley, Pan American Petroleum Corporation, Tulsa, secretary-treasurer.

Edward F. Shea, retired, Catoosa, Okla., served as chairman of the ballot committee. The following Tulsa geologists served with Shea: Hugh Hay-Roe, Jersey Production Research Company; Robert J. Lantz, The Pure Oil Company; E. A. Markley, independent; L. Claude Roark, Buffalo Oil Company; Russell S. Tarr, independent; Jess Vernon, retired, and Joseph K. Wetherill, Kewanee Oil Company.

Central Canada Scouts Names Sparrow President

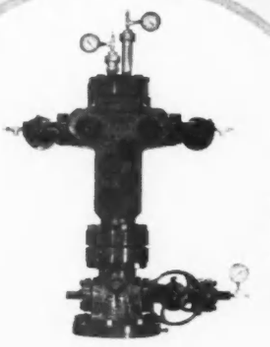
William Sparrow, Phillips Petroleum Company, was elected president of the Central Canada Oil Scouts Association at a meeting recently held in Regina, Sask.

Other officers are D. A. Drummond, Devon Palmer Oils, vice president, and E. F. Lee, Shell Oil Company, treasurer.

O·C·T HAS THE RIGHT EQUIPMENT FOR LOW PRESSURES, HIGH PRESSURES or any pressure in between.....

ASK THE O·C·T REPRESENTATIVE NEAREST YOU ABOUT A NEW SERIES OF LOW PRESSURE EQUIPMENT

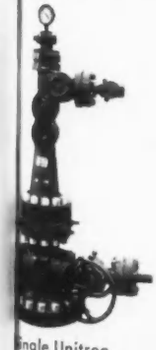
iple Block Tree



Dual Unitree

Threaded dual tree with Crescent Flange Bottom

Triple Tri-Flange Tree



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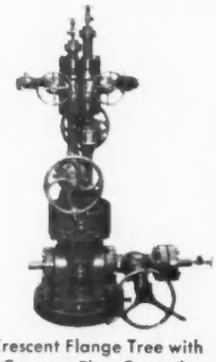
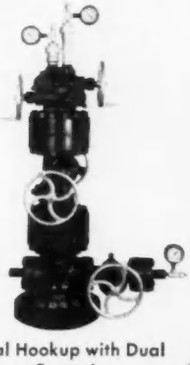


Crescent Flange Tree with Crescent Flow Controls



Dual Hookup with Dual Controls

where progress is a daily practice

O·C·T

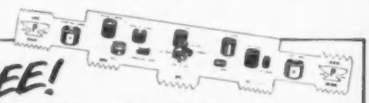
OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to P. O. Box 3091, Houston, Texas.

Anvil Brand Couplings start clean, run up fast because threads and chamfers are precision machined, gaged throughout manufacture, and electro-galvanized. Uniform wall thickness and properly aligned sealing surfaces provide dependable mechanical strength and full joints for trouble-free string service, minimum maintenance.

Anvil Brand Fittings—A.P.I. Couplings for all oil field applications, bushings, plugs, and nipples, are sold through your nearest supply store. Engineering service is always available from Anvil Brand Representatives in key oil country locations. Write for information.



FREE!

POCKET SIZE THREAD GAGE

Identifies threads from 8 to 14 per inch, round or sharp, external or internal. Only 6¼" long. Write Oil Field Dept., Pittsburgh Pipe and Coupling Co., Allison Park, Pa.

ANVIL BRAND
forged seamless and wrought steel pipe fittings

PITTSBURGH
PIPE and COUPLING COMPANY
ALLISON PARK, PA., U.S.A.

Subsidiary: Anvil Products, Inc., Longview, Tex.
Affiliate: Canadian Coupling and Fittings, Ltd., Simcoe, Ont.

Suppliers' notes

D. E. Whittenberg

R. E. Dunn

J. T. Conner

R. V. McAfee

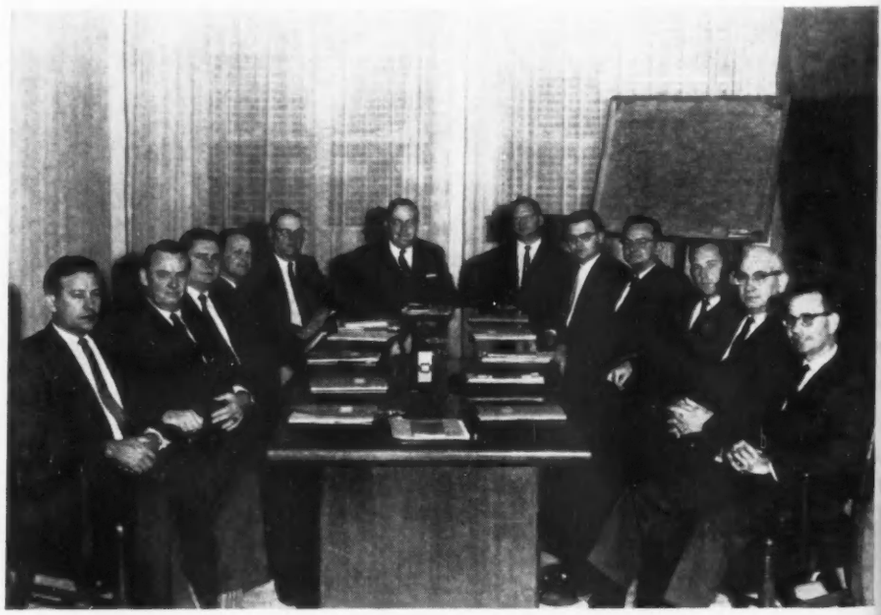
D. E. Whittenberg, vice president—sales, **Garrett Oil Tools, Division of U.S. Industries, Inc.,** has assumed broader responsibilities and in the future will be responsible for executive office customer relations and will assist the president with the general administration of the division. He will also serve as general manager of the division in the absence of the president. **Robert E. Dunn** has been named manager of marketing, where he will be responsible for supervising and directing the Sales Department. **J. T. Conner,** who has served as Garrett's South Louisiana district manager for several years, has been promoted to the new position of field sales manager. He will supervise all sales districts, including **Garrett Oil Tools, Ltd. (Canada),** and domestic sales agents. **R. V. McAfee,** associated with Garrett since 1950, will be responsible for establishing and conducting all sales training programs. He will continue to be headquartered in Houston.

W. L. Parcell has been elected executive vice president of **The Ridge Tool Company,** Elyria, Ohio. Also, **R. D. Frye** was named sales manager and **H. L. Palmer** was appointed advertising manager and assistant to the sales manager. **J. A. Frates** is president of the firm.

E. R. Sternberg has been named chief engineer of **White Truck Division, The White Motor Company.** He had been chief engineer of the company's Autocar Division at Exton, Pa.

William G. Barnes has been appointed sales manager of Blast Hole Drills, **Bucyrus-Erie Co.** He will report to **George D. Grayer,** manager of sales for the drill division.

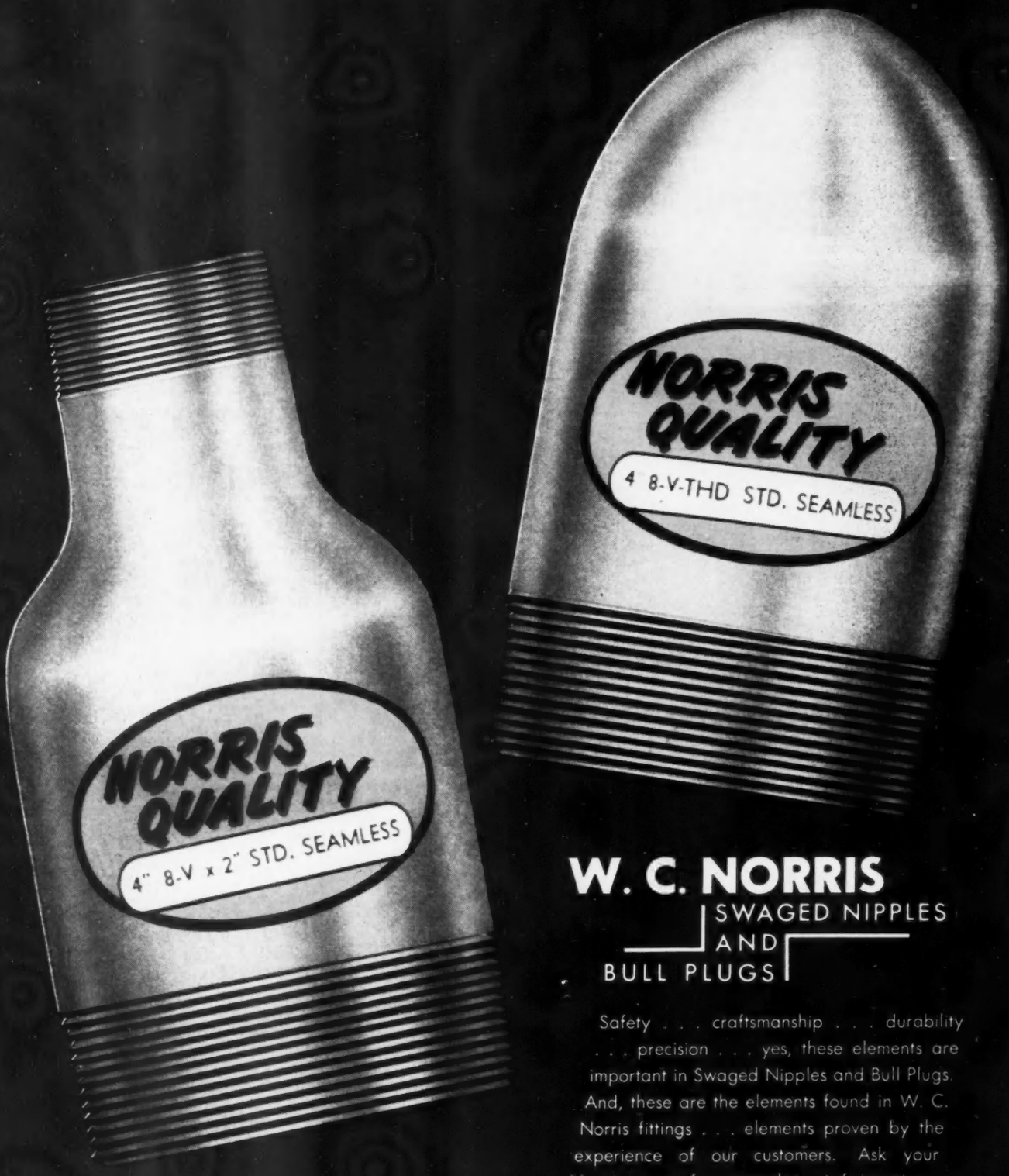
Ralph L. Gray has been elected chairman of the board, and **Logan T. Johnston** was chosen to succeed Gray as president of **Armco Steel Corporation.**



Republic Supply Completes Managers Conference

The Republic Supply Company completed its District Managers Conference recently at the general offices in Oklahoma City. Attending the conference from the field were M. D. Gilmore, Wichita Falls, Texas; Ray Prater, Denver; G. M. McClintic, Oklahoma City; H. L. Ellis, Odessa, Texas; H. G. Huddleston, Wichita, Kan.; T. P. Nelms, Corpus Christi, Texas; J. C. Bergin, Lafayette, La.; H. H. Haire, Salem, Ill.; Roy Black, Amarillo, Texas. Presiding at the conference was C. J. Jump, general manager of sales. Assisting him were J. F. O'Neill and George Tope, manager of tubular sales.

PROVEN BY EXPERIENCE



W. C. NORRIS
SWAGED NIPPLES AND BULL PLUGS

Safety . . . craftsmanship . . . durability . . . precision . . . yes, these elements are important in Swaged Nipples and Bull Plugs. And, these are the elements found in W. C. Norris fittings . . . elements proven by the experience of our customers. Ask your Norris man for complete information.

NORRIS QUALITY TUBULAR PRODUCTS

Buy From Your NORRIS Distributor

W. C. NORRIS, MANUFACTURER
DIVISION OF DOVER CORPORATION
TULSA, OKLAHOMA • P. O. BOX 1739

BRANCHES: Great Bend, Kansas; Corpus Christi, Houston, Kilgore, Odessa, Wichita Falls, Texas; Oklahoma City, Oklahoma; Salem, Illinois; Casper, Wyoming; Farmington, New Mexico; Edmonton, Alberta, Canada.

SUCKER RODS

• OTHER NORRIS CHAMPIONS

VALVES 150 PSI

WELL HEAD EQUIPMENT

Suppliers' notes

Robert Lewis Kelly has been appointed city representative in New Orleans for **U.S. Steel's Oil Well Supply Division.**

Robert F. Horton has been appointed city representative of **U.S. Steel's Oil Well Supply Division** in Houston, and **Gerritt I. Wyckoff** as manager, waterflood and well servicing pump sales at Tulsa.

Stephen W. Cotton, formerly a vice president, has been elected president of **C. W. Cotton Supply Company,** Tulsa, succeeding **C. W. Cotton** who was named chairman of the board.

J. L. Pausch

H. Knippenberg

John L. Pausch has been named to the newly created position of chairman and **Henry Knippenberg** has been appointed president and general manager of **Dresser Ideco Company.**

Wesley A. Songer has been elected president and chief administrative officer of **Crane Company.** He was formerly executive vice president. **L. H. T. Clegg,** president of **Crane, Ltd., Montreal,** has been acting president since April 28, and will continue as president of Crane, Ltd.

August V. Segelhorst has been named chief engineer and director of Research for **Bowen Itco, Inc.,** with headquarters in Houston. He replaces **C. B. Greer** who resigned. **William T. Lee** is now engineer in charge of Production Engineering and **D. Jay Bond** is engineer in charge of New Tool Development.

J. B. (Bob) Bender, sales manager for **Walter O'Bannon Co.,** has been elected a vice president of the firm.

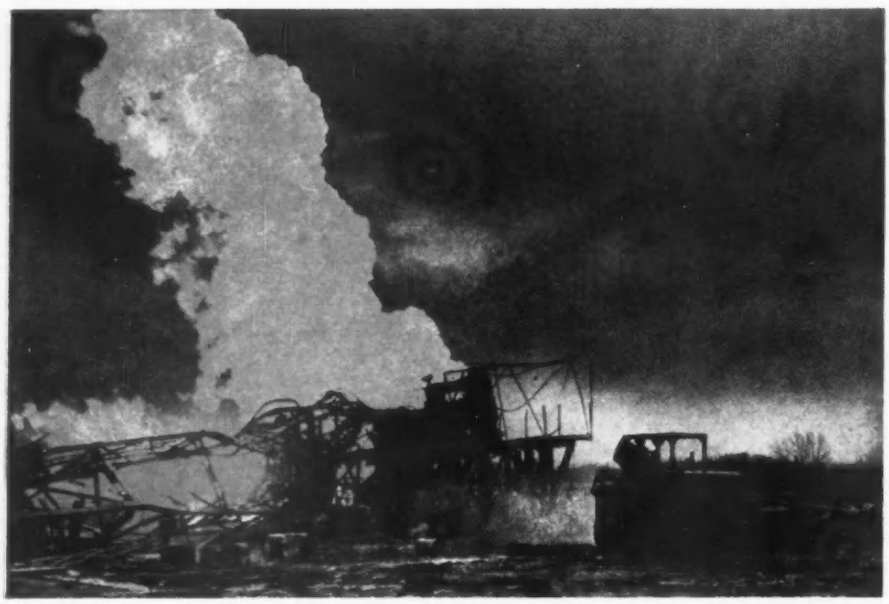
Aloysius M. Tullo, vice president and general manager of **Worthington Corporation's** Harrison (N. J.) Division, has become a group vice president of the corporation. He replaces **Elston J. Tribble** who resigned. **William A. Finn,** general manager of Worthington's (Holyoke, Mass.) Division, has been promoted to general manager of the Harrison Division.

Gordon M. Mace, Jr., has been elected a vice president of **Independent Exploration Company,** Houston. Mace resigned as president of Marine Exploration Company, Houston, to join Independent Exploration when that firm bought out the geophysical operations of the Marine Company.

J. R. (Dick) Yancey has been promoted to vice president of the **Oil Center Tool Company.** He will continue to serve as chief engineer. Yancey joined Oil Center Tool Co. in 1956 as a research and development engineer and was named chief engineer in September of 1957. Yancey is affiliated with the American Society for Metals.

J. R. Yancey

Weldon Martin has been appointed executive vice president of the **Weatherford Oil Tool Company.** Heading operations in the Eastern Hemisphere are **Thomas E. Remp, Jr.,** of Hannover, Germany, vice president Foreign Distribution; **Addison Love,** vice president chief engineer and works manager (Foreign). **F. H. Drurry, Weatherford Oil Tool Co., Ltd.,** Edmonton, Alta., was appointed vice president at large. Also appointed vice president at large was **R. H. Hume,** president of **Fabrimex S.A. de C.V.,** Mexico City, a subsidiary company. **James C. Niver** of Houston is now vice president of Finance. **Walter Carter** of Weatherford, Texas, is vice president of the Ranch Division. To continue as vice presidents are: **Fredda Dodd** of Houston, vice president chief accountant; **Ben**



A "Pit-O-Graf" MIGHT HAVE SAVED THIS WELL

A Pit-O-Graf can give adequate warning to prevent a blowout. But, it must be where the driller can see it, can take advantage of it. Here's what users have to say:

One oil company says — "Although blowout prevention is a matter of concern for the operator, the contractor, and the drilling crews, generally *the driller is the key man.*"

Another company says—"Since a pit level indicator is so important, take these precautions to get the most good out of it: Place the pit level recording instrument at or near *the driller's position on the derrick floor.*"

If the driller's responsibility is not misplaced, then he can recognize the danger signals that precede every blowout. With the Pit-O-Graf record before him, he can intelligently analyze the *rate* of gain or loss of mud as recorded and thereby direct his crew in the orderly control of the situation at hand. In this case the threatened blowout would become *one that does not happen.*

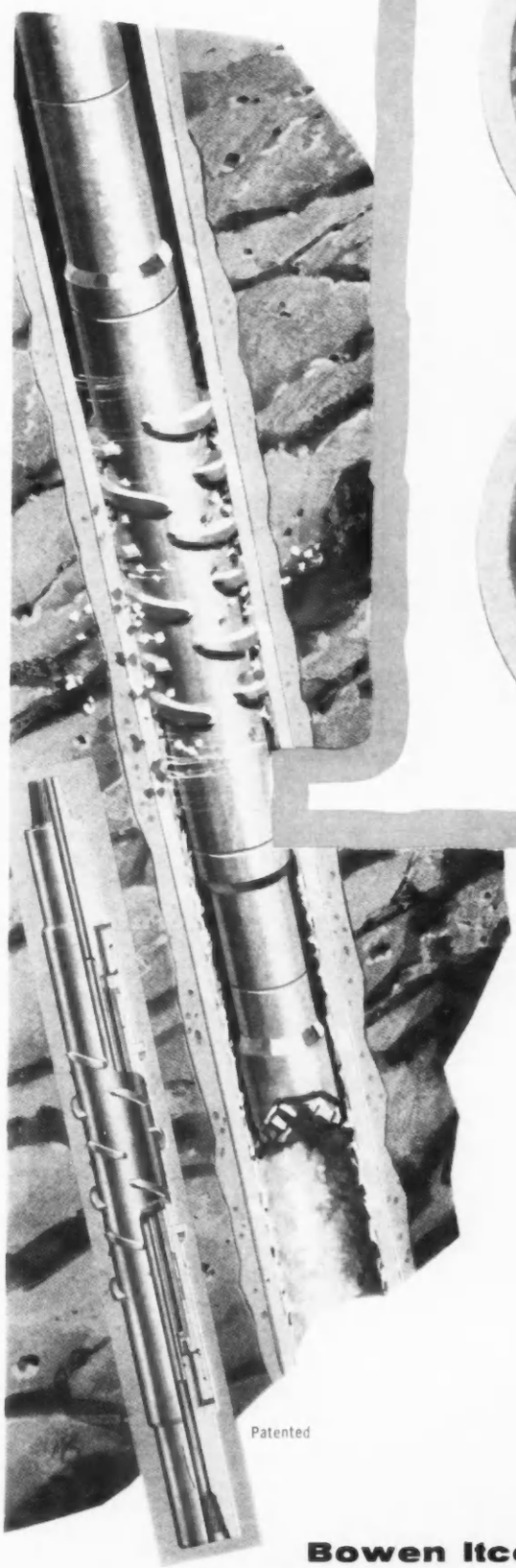
WARREN AUTOMATIC TOOL CO.
3915 THARP STREET • HOUSTON, TEXAS
Phone CApitol 4-2511

Lake Charles HEmlock 6-2265 | New Iberia EMerson 9-9862 | Harvey FOrest 6-1441

Bowen Casing Scrapers

GIVE PRODUCTION TOOLS

A CHANCE TO WORK!



Patented

Save hours of rig time, needless expense with a Bowen Casing Scraper. Rust, mill scale, cement, perforation burrs, and other obstructions can prevent proper operation of down-hole tools, ruin composition or rubber materials, prevent passage of close-tolerance equipment. A Bowen Casing Scraper removes such obstructions, leaves the inside of your casing clean and smooth.

Scrape up or down. Blades give full 360° coverage, never deflect or miss patches of cement, rust or scale, never skip over perforation burrs. Blades are held firmly from the inside of the tool, cannot be lost in the hole, are easily changed in the field.

Ask for Bowen Casing Scrapers. They're available in every drilling and producing area. Write for descriptive literature.

BOWEN

Bowen Itco, Inc. P. O. Box 4587, Houston 13, Texas

For more data on advertised products, use Readers' Service Cards, last page.

Suppliers' notes

Owens of Weatherford, vice president works manager (Domestic), and **Homer Longio,** Houston, vice president Distribution (Domestic).

J. W. (Bill) Wallace has been appointed district salesman for **Instruments, Inc.,** of Tulsa. Wallace will occupy offices in the Gulf Building, Houston.

M. H. Fesler has been named **Kobe, Inc.**'s western industrial sales representative and will make his headquarters in the company's main plant at Huntington Park, Calif.

J. W. Borror

John W. Borror has been promoted to assistant sales manager at **Herb J. Hawthorne, Inc.,** of Houston. Borror's more than 20 year's experience throughout the Mid-Continent, Texas and Gulf Coast areas will be applied to field engineering problems of shot hole, core hole and slim hole drilling industries.

John P. DeHetre has been appointed general manager of sales of **The Youngstown Sheet and Tube Company,** succeeding the retired **John M. Tuthill.**

Walter M. O'Malley, vice president in charge of Marketing, **Aero Service Corporation,** has been elected to the company's board of directors.

Keith McCarley has joined the **Tyson Smith Company** as manager of the Corpus Christi District.

Charles Farr is the operating engineer-in-charge of the new offices recently opened by **Lane-Wells Company, a division of the Dresser Industries, Inc.,** in Atwood, Kan.

J. C. Myrick is in charge of the new office opened at Kilgore, Texas, recently by **Tuboscope Company of Houston.**

Dillard R. Thomas has been named administrative assistant to the sales manager for **Reed Roller Bit Company** of Houston.

Gerald Pope, formerly manager of sales, has been advanced to vice president, sales, for **The J. B. Beaird Company, Inc.**

R. E. Batchelor

W. J. Bovaird

William J. Bovaird has been advanced from sales manager to vice president-sales for **Bovaird Supply Company** following the annual stockholders and directors meeting. Also, **Raymond E. Batchelor** was advanced from vice president and general manager of sales to vice president and general manager. **Roscoe G. Ayers** was advanced from vice president and general manager to senior vice president. Other officers who remain in their present positions are **T. H. Trower,** secretary-treasurer, and **M. B. Sparks,** assistant secretary-treasurer.

R. G. Ayers

Kenneth M. Cook, formerly sales representative at Abilene, Texas, for **W. C. Norris, Manufacturer,** has been appointed sales manager of the company's Central Division with offices at Tulsa. He succeeds **J. A. Getty, Jr.,** who has been made head of the General Products Engineering Division. **Ed Chaney** succeeds Cook at Abilene.

You've Asked For It....

So-Here It Is!

The rugged new JENSEN COMBINATION JACK. Combines the advantages of both the Beam—Balanced Units and the Rotary Units. Proof, JENSEN keeps up with the needs of oil producers.

For more information drop a card or letter to us at Coffeyville, or better still—ask about the JENSEN COMBINATION JACK at Your Local Supply Store.

Made by JENSEN BROS. MFG. CO., INC., P. O. Box 377-C, Coffeyville, Kansas
Export Office: 250 Park Avenue, New York 17, N. Y. U.S.A.

JENSEN JACKS

IVERSON SUPPLY COMPANY EXPANDS

IN OKLAHOMA CITY AREA WITH NEW SALES OFFICE

IVERSON SUPPLY CO. C.O. OIL WELL SUPPLIES

OKLAHOMA CITY OFFICE
901 CRAVENS BUILDING
CEntral 2-7852

IVERSON SUPPLY CO. C.O. OIL WELL SUPPLIES

STORES:

OKLAHOMA —
Oklahoma City,
Okmulgee.

NEW MEXICO —
Artesia,
Farmington.

TEXAS —
Kermit, Odessa,
Snyder.

COLORADO —
Cortez.

The Iverson Supply Company is proud to announce the opening of a new sales office in Oklahoma City, to serve the oil industry in that area.

The new Oklahoma City office is ready to provide you with immediate, efficient service on all of your petroleum equipment requirements. The Iverson Supply Company is known for the quality of equipment handled, with every item backed by a confident guarantee of satisfaction.

In Oklahoma City, as in all major oil producing areas . . . CHECK WITH IVERSON, *whatever your requirements!*

OFFICES:
FT. WORTH, TEXAS
DALLAS, TEXAS
MIDLAND, TEXAS
HOUSTON, TEXAS

IVERSON SUPPLY COMPANY

DRILLING-PRODUCTION AND REFINERY EQUIPMENT
GENERAL OFFICES
P. O. BOX 1439 TULSA 1, OKLA.

OFFICES:
DENVER, COLORADO
TULSA, OKLAHOMA
OKLAHOMA CITY, OKLA.

For more data on advertised products, use Readers' Service Cards, last page.

Suppliers' notes

S. D. Goins

S. D. Goins has joined the **Baash-Ross Division of Joy Manufacturing Company** as operations manager in the company's Odessa, Texas, plant. Prior to joining Baash-Ross, Goins was general superintendent since 1944 of Bethlehem Steel Company, Supply Division, at Corsicana, Texas.

William F. Martin has been appointed director of Manufacturing Services for **Borg-Warner Corporation.**

Baker Acquires Collar Line Of Hayward Testing Service

Baker Oil Tools, Inc., has announced the acquisition of Hayward Testing Service's cementing collars and related equipment.

The equipment, to be known as Baker-Hayward collars, can be mechanically opened, closed, and, if necessary, reopened to provide access into the casing-to-formation annulus by either vertical or rotary casing movement. Other models are opened by a wireline tool and closed by a follow plug, or are opened and closed by rotating a special straddle tool that is run in on tubing or drill pipe.

Initially, Baker will market and service these products only in California. It is anticipated, however, that Baker-Hayward collars will soon be available in many other areas. The Baker-Hayward collars will supplement the Baker stage cementing collar and provide operators with increased flexibility in stage cementing and other operations requiring the injection, displacement or recovery of fluids in the annulus.

Baash-Ross Purchases Web Wilson Oil Tools

The Baash-Ross Division of Joy Manufacturing Company in Houston has disclosed the recent purchase of Web Wilson Oil Tools, Inc., of Los Angeles. In making the announcement, Hammond A. Helms, vice president and general manager of the Baash-Ross Division, said that the Web Wilson firm will be integrated into the Baash-Ross Division.

Purchase of the firm was a move in the Baash-Ross expansion program. Helms said that with the added tools and sales personnel of Web Wilson, the Baash-Ross Division will be able to offer a more complete line of drilling tool products.

William A. Wilson, president of the Los Angeles oil tool firm, will become a divisional vice president and manager of the West Coast operations of Baash-Ross.

Newly Formed Houston Firm Will Handle Gas Lift Valves

A new firm to handle the sale and manufacture of gas lift valves has been formed in Houston under the name of MGL Corporation.

Principals are Allen F. Rhodes, president, and Charles B. Wright, Jr., vice president and general manager. Rhodes is vice president of engineering and manufacturing for the McEvoy Company of Houston, and Wright was formerly general manager of the McEvoy Gas Lift Division.

The new firm was established as the result of the McEvoy Company's recent decision to discontinue the manufacture of its gas lift valve in order to concentrate solely on the expanding production and sale of the McEvoy gate valve. The firm subsequently sold manufacturing rights to the gas lift valve to a group of its employes.

Current headquarters of the new firm are located on South Main in Houston, but long range plans call for construction of its own manufacturing plant. Though the present organization is primarily sales, MGL plans not only to manufacture the valves, but also, eventually to develop, manufacture and sell allied products.

Industrial Supply Installs Down-Well Pump Repair Shop

Industrial Supply Company, Wichita Falls, Texas, has just completed installation of a new down-well pump repair shop. This shop has been modernized with the Gearench system. Installation of this new equipment enables Industrial Supply to offer the newest methods of down-well pump repair.

eye to overheads
Low running costs, easy maintenance, maximum accessibility—Paxman diesels were built with an eye to overheads. Built to ensure profitable operation for land and offshore drilling. But the advantages of Paxman diesels go even further... their price is right, delivery is fast and freight costs are rock bottom. More... these power packed Paxman diesels are backed by a world-wide agency network and a real after-sales service.
A Paxman "Dritpak" 400F, the world's most advanced packaged power unit, for drawworks and slush pump drive.
A compact Paxman 8RPHM marine propulsion diesel, developing 340 s.h.p. at 1500 r.p.m.
PAXMAN DIESELS for the oilfields
7" and 9¼" bore diesels—ranging from 90 to 2310
DAVEY, PAXMAN & CO. LTD., COLCHESTER, ENGLAND a member of the HUSTON Group
PO 4

New York Representatives: Beckley, Haltom & Hickman, The Americas Building, Rockefeller Center, 1270 6th Avenue, New York 20.
Spares service facilities to match oilfield requirements.

HOMCO

ASSOCIATED A OIL FIELD RENTALS

HOMCO ALSO OFFERS

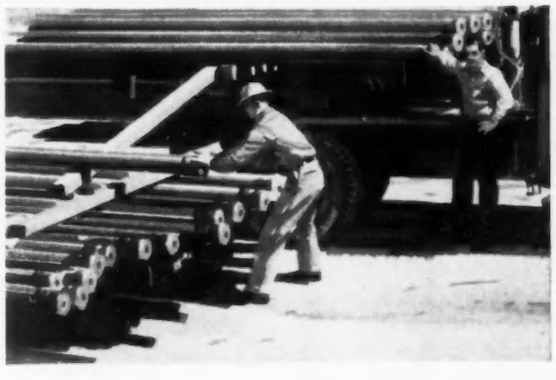
- Electrical Well Services
- Fishing & Cutting
- Directional Drilling
- Complete Supply Service

2. The most complete stock of oil field rental equipment in the world.

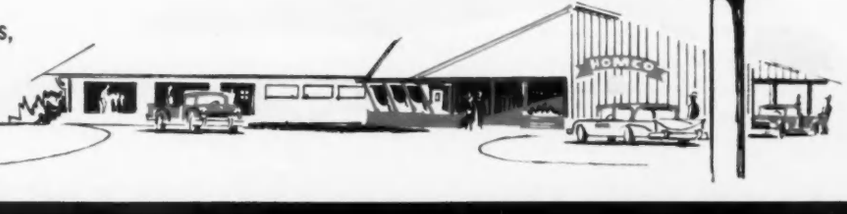
3. Complete facilities throughout the oil fields.

4. Pricebook contains complete engineering and specification tables. Available to operators on request.

Typical of the items available are: the HOMCO Power Swivel, the HOMCO Mud-Miser, blowout equipment, drill collars, and drill pipe.



OVER 55,000 RENTAL ITEMS . . .
the world's largest selection of oil field tools, ready for you at HOMCO-ASSOCIATED



Wiley BOOKS

1.

SUBSURFACE MAPPING

Preparation and Interpretation, by MARGARET S. BISHOP, *University of Houston.* Vital to the oil geologist, this book stresses the new stratigraphic-type maps so valuable in oil exploration. It also explains straight to the point the various other kinds of maps that may be made to present subsurface data, plus a discussion on how to interpret them. An immediately practical volume for the technical man.

1960. 198 pages. $5.75

2.

THE SEA OFF SOUTHERN CALIFORNIA

A Modern Habitat of Petroleum, by K. O. EMERY, *University of Southern California.* Develops relationships among physiography, structure, water, sea life, ocean sediments—then shows their influence on origin, migration, and accumulation of oil.

1960. 366 pages. $12.50

3.

PETROLEUM GEOLOGY

Second Edition, *by* KENNETH K. LANDES, *University of Michigan.* Largely rewritten, the new edition takes as a theme the geological occurrence of oil and how it can be found in commercial deposits. Covers theory of evolution of oil and techniques of exploration. Includes a valuable chapter on reservoir seals, many case histories.

1959. 495 pages. $9.50

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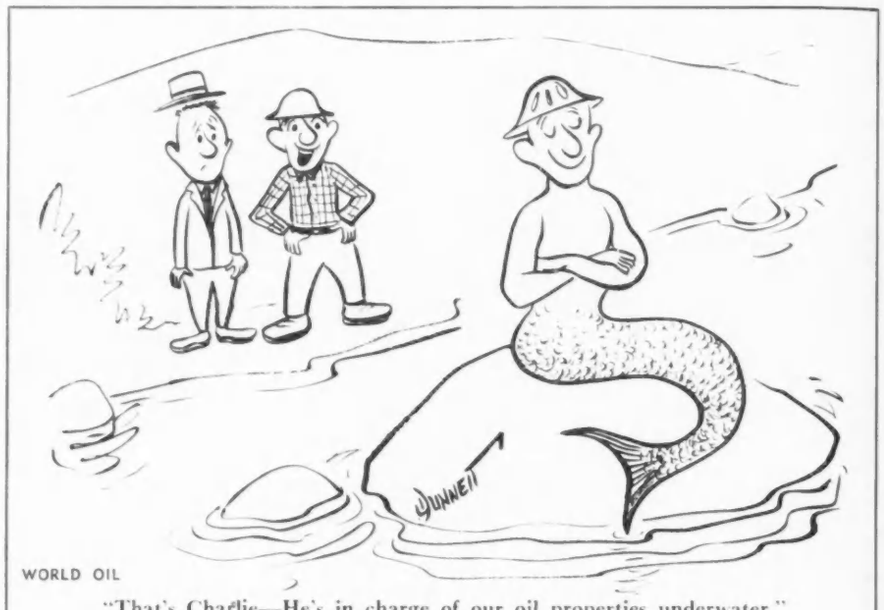
SQUEAKS

From the Bull Wheel



WORLD OIL

"That's Charlie—He's in charge of our oil properties underwater."

One Good Slug . . . and . . .

Two moonshiners on their first train ride had never heard of soda pop, so when the vendor came through the car they each bought a bottle.

The first mountaineer wiped the lip of the bottle and took a long drink—just then the train entered a tunnel.

"How'd you like it, Jed" asked his companion in the darkness.

"Don't tech that stuff, Lem. I been struck blind."

Our Learned Years

An undergraduate acquaintance of ours has discovered a way to cut classes at the correspondence school he's attending. He sends in empty envelopes.

Life of The Party

"Oh, I had a wonderful time" cooed the coed to her sorority sister. "Everybody said that Tommy and I were the cutest couple on the floor."

"I thought you said you weren't going to the Senior Dance," puzzled her friend.

"We didn't," said she, smiling. "Tommy took me to a pajama party."

It's Only The Facts, Man

Our Research Department has just come up with a stack of statistics proving that a considerable number of college students **do not** make love in parked cars. In fact, the report continues, the woods are full of them.

Advice to The Bridegroom

Don't be so absorbed in bringing home the bacon that you forget the apple sauce.

The Faithful One

The psychiatrist was not sure that his patient was normal. Suspiciously he asked: "What do you do in your spare time?"

"Oh," the man blushed, "I just sit around mostly."

"Hmmmm—never go out with girls?"

"No."

"Don't even want to?"

The man was uneasy. "—Well, yes, sort of."

"Well, why don't you?"

"My wife won't let me."

The Economic System

Civilization is a system under which a man pays a quarter to park his car to keep from paying a dollar fine while spending a dime for a nickel cup of coffee.

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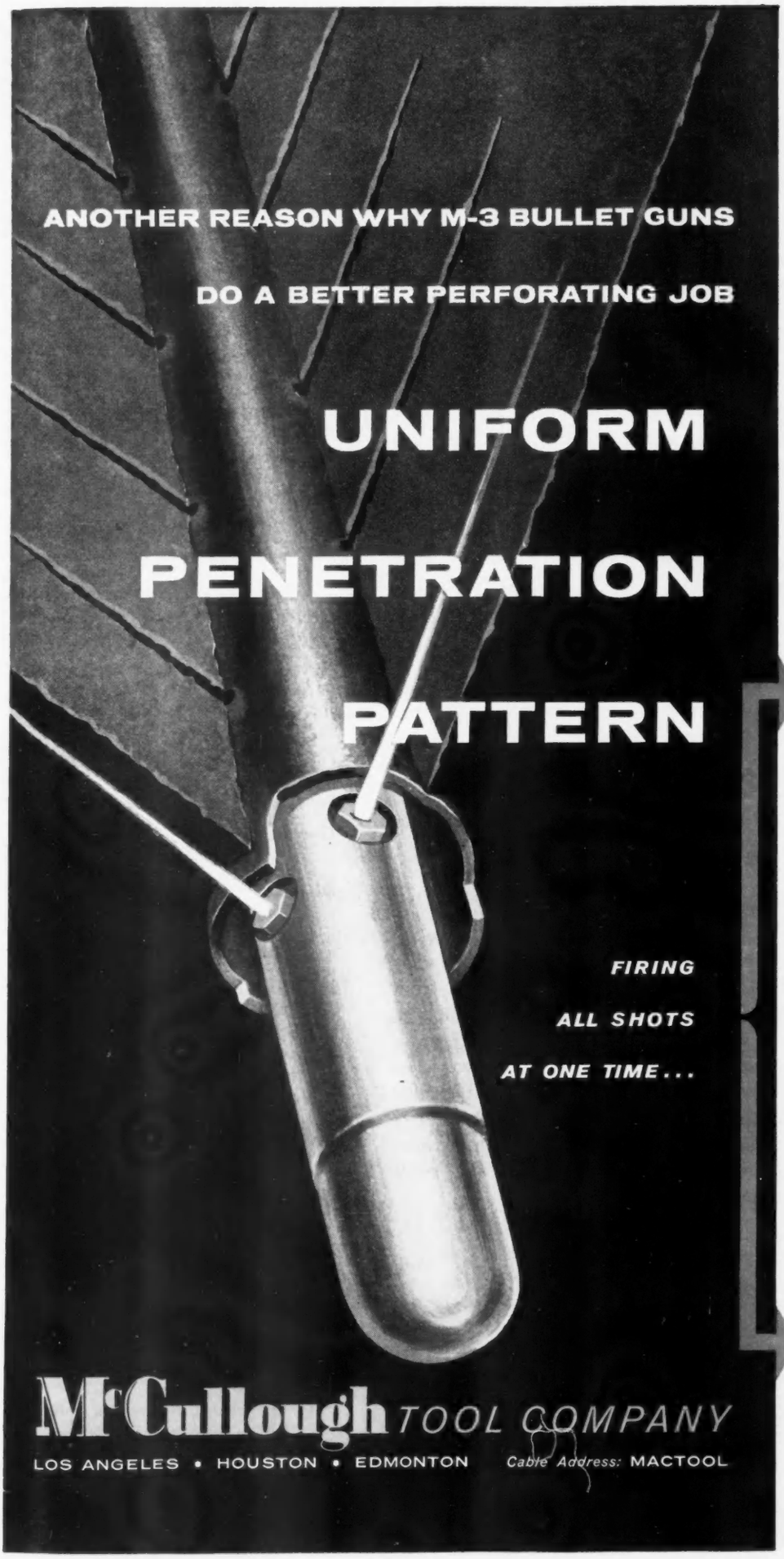

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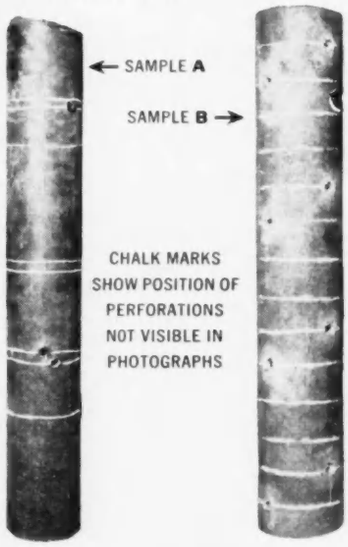
prevents bunching of shots in one small area in pay zone, giving insufficient coverage – prevents scattering of shots over a wide area, possibly missing the pay zone entirely. Sample A (actual photo of pipe recovered from well) shows the erratic shot pattern produced by a gun firing one shot at a time. As each shot is fired the upward thrust of released gases causes the gun to dance up and down.



eliminates the danger of possible pipe damage or failure. Too many perforations in one spot or in a coupling can cause pipe to part if it is in severe tension. Sample B is an actual example of six shots per foot fired by an M-3 Bullet Gun. Note the uniformity of shot pattern – no danger here of seriously weakening your casing, and you get the most productive perforating job possible.

Gimme' Room Man

An Alaskan on arriving in Texas approached a bystander and asked, "Where may I find a doctor?"

"Are you ill?" inquired the Texan.

"No," grinned the Alaskan, "I'm suffering from Claustrophobia."

The Breaks of Life

Charlie had a horrible dream the other night. He dreamed his wife and Elizabeth Taylor were fighting over him—and his wife was winning.

Sometimes, You Just Can't Tell

"Just because my eyes are red is no sign I'm drunk. For all you know, I may be a white rabbit."

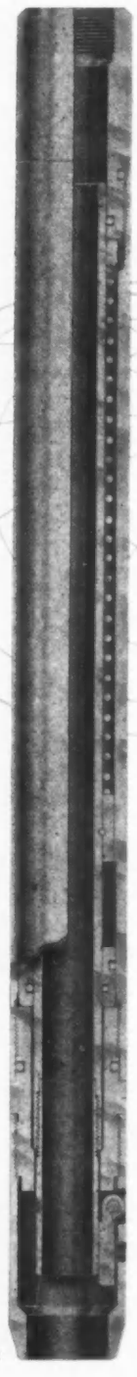
Be Efficient, But Use Tact

The plumber was breaking in a new assistant by introducing him to some of the niceties of the trade.

"Above all," says the plumber, "you must exercise politeness and tact."

The assistant allowed as to how he knew and understood politeness, "but what is tact?"

"Well, it's like this," explains the plumber, "say you go to an apartment to repair some plumbing and you walk into a bathroom while a young lady is in the nude. You goes ahead with your repairing job but you says, 'Beg your pardon, sir.' The 'beg your pardon' is politeness. The 'sir'—that's tact."



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C 602

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Read the Small Print

The farmer's barn had just gone up in smoke, and his insurance agent was trying to explain why he couldn't collect cash for it.

"Read the policy," he insisted. "All our company engages to do is build you another barn exactly like the one that's destroyed."

"Well, if that's the way you varmits do business," raged the farmer, "you can just cancel the policy on my wife."

High Finances

Nero was talking finances with one of his officers in the amphitheatre in Rome. "We aren't making much money from this building," Nero said. "Any ideas why?"

"Yes, I know," replied the officer. "The lions are eating up all the prophets."

Where Were You . . . ?

The Shah had a son and to distinguish him from his father, they called him "The Shan." He suffered from epilepsy and an orderly was appointed to watch over him. One day in an unguarded moment The Shan got too much sun and had a fit. The Shah sent for the orderly and angrily asked him, "Where were you when the fit hit The Shan?"

Last of The Big-Time Spenders

The breadwinner came home lopsided and explained that he did not have his paycheck. "I bought something for the house," he explained.

"And just what did you buy for the house?" asked his wife.

"Twelve rounds of drinks."

The Long Way Around

Madam: "You can't come in here, Sonny, you're too young. Besides, you might catch a bug."

Junior: "That's what I want—the bug. I'll give it to the maid and she'll give it to my father. He'll give it to my mother and she'll give it to the milk man. He's the guy I'm after—he ran over my new bike."

It's The Awful Truth

Said the kind old lady to the Internal Revenue clerk, "I do hope you'll give my money to some nice country."

All Right, Class . . .

The Sunday School teacher was reviewing a lesson. "Who led the children of Israel out of Egypt?"

No answer. So she pointed to a small lad at the back of the room.

"Wasn't me, ma'm," he answered timidly. "We just moved here from Tulsa."

How Now, Brown Cow

Stressing the importance of a large vocabularly, the English teacher told his class, "use a word 10 times and it will be yours for life."

In the back of the room a pert blonde closed her eyes, and was heard chanting under her breath: "Fred, Fred, Fred, Fred, Fred, Fred, Fred, Fred, Fred, Fred."

Number Pleeze

"Hell, yes," said the Devil, picking up the phone.

Announcing

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Chicago Pneumatic proudly announces its new SLANT-JET Three Cone Rock Bit . . . the result of more than two years of intensive research and field test. We feel this is the greatest advance in bit design since the introduction of the first jet bit.

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CP SLANT-JET Bits are available *now* for immediate shipment in sizes of 6″ to 6-3/4″. The 7-7/8″ size is being issued in limited quantities, and other sizes will be available as soon as possible.

*PAT. PENDING

Chicago Pneumatic FORT WORTH, TEXAS

NEW books, maps and movies

ESTIMATOR'S ELECTRICAL MAN-HOUR, Gulf Publishing Company, Houston 1, Texas, John S. Page and Jim G. Nation, $10.

The second in Gulf Publishing Company's Estimator's Library. The scores of man-hour tables in this manual were compiled after detailed analysis of many time and method studies, covering all phases of electrical installations.

The manual points out how to arrive at a composite rate using productivity efficiency and production elements. With the composite rate, man-hour estimating can be applied with equal validity to any electrical job, in a location.

Subject areas include: Section 1—Conduit, Boxes and Fittings; Section 2—Service and Feeder Wiring; Section 3—Branch Circuit Items; Section 4—Lighting Fixtures; Section 5—Panelboards and Cabinets; Section 6—Safety Switches; Section 7—Hangers and Fasteners; Section 8—Underfloor and Buss Ducts; Section 9—Starters and Motors; Section 10—Mounting Transformers; Section 11—Outside Construction; Section 12—Underground Duct and Cable; Section 13—Communications and Signal System; Section 14—Demolition, Excavation and Concrete, and Section 15—Technical Information.

HISTORY OF HUMBLE OIL AND REFINING COMPANY, Harper Brothers, New York, Henrietta M. Larson and Kenneth Wiggins Porter.

The volume traces the efforts by the company's administrators and employes to carry on the producing, transporting and refining crude oil and selling crude and products. The history shows how a growing company undergoing rapid technological change in a highly competitive industry has adapted its personnel, concepts and techniques to meet new problems and opportunities. The book is also illustrated with 32 pages of photographs and 20 maps and charts.

FOSSILS IN WASHINGTON, Washington Department of Conservation, Olympia, Wash., Vaughn E. Livingston, Jr., 25 cents.

This 35-page illustrated pamphlet has been published especially for beginning collectors, students and amateurs. Booklet lists many localities in Washington where fossils of various geologic ages may be collected. Localities are shown on an index map, and throughout the report are drawings of the kinds of fossils to be found in places described.

PETROLEUM GEOLOGY, SECOND EDITION, John Wiley & Sons, Inc., New York, Kenneth K. Landes, $9.50.

The greater part of the book deals with modern theories of the origin and evolution of oil and gas, rocks which contain oil and gas, associated fluids in the reservoirs, the migration of hydrocarbons through the rocks, and the various types of traps in which commercial deposits occur.

The role played by fractures, both in the migration and storage of oil, is given considerable discussion, and the habitat of oil is covered in detail.

OIL AND PETROLEUM YEAR BOOK 1959, Walter E. Skinner, 20, Copthall Avenue, London, E.C.2, $7 Post Free.

This new edition contains the following features: "World Oil Companies" Section: containing complete and up-to-date particulars of 1,100 of the principal British, American, Canadian and foreign oil companies, opearting in all parts of the world and covering all branches of the industry; "International Buyers' Guide": comprising over 2,000 headings and entries of international manufacturers and suppliers of plant, equipment, accessories, geophysical and prospecting companies; "Managers, Engineers & Agents" Section: giving 730 names and addresses and the companies in this edition with which they are associated; "World Crude Oil & Natural Gasoline Table": showing the annual world production in countries from 1949 to 1958; Color maps of the Middle East oil fields, refineries, pumping station & pipe lines and the Trans-Canada Natural Gas Transmission System.

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■ 2 summer's experience in subsurface mapping w/major company in Oklahoma. M.S. in June 1960. Married. Army Reservist officer. Will locate anywhere. Box 211-W, WORLD OIL, Houston, Texas.